# High-Performance Desktop PC

HEATH

**ZENITH** | **data systems**

## REGULATORY INFORMATION

*Warning* —— This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference with radio and TV reception.

NOTE: In order to meet Class B emission limits, the user must comply with the following requirements:

1.  The cables that interconnect between this computer and any peripheral (such as a printer, modem, etc.) must be shielded.

2.  The power cord shipped with the computer is shielded. If you replace the power cord, be sure to use only a shielded power cord.

This equipment generates and uses radio frequency energy for its operation and if not installed and used properly, that is, in strict accordance with the instruction manual, may cause interference with radio and television reception. It has been tested and found to comply with the RF emission limits for a Class B computing device which is intended to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference with radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

*   Move the computing device away from the receiver being interfered with.
*   Relocate (turn) the computing device with respect to the receiver.
*   Reorient the receiver's antenna.
*   Plug the computing device into a different AC outlet so that the computing device and receiver are on different branch circuits.
*   Disconnect and remove any I/O cables that are not being used. (*Unterminated* I/O cables are a potential source of high RF emission levels.)
*   Unplug and remove any circuit boards that are not being used. (Here again, *unterminated* cards can be a source of potential interference.)
*   Be certain that the computing device is plugged into grounded outlet receptacles. (Avoid using AC cheater plugs. Lifting of the power cord ground may increase RF emission levels and may also present a lethal shock hazard to the user.)

If you need additional help, consult your dealer or ask for assistance from the manufacturer. Customer service information may be found in the "Care and Service" chapter of this manual. You may also find the following booklet helpful: *How to Identify and Resolve Radio-TV Interference Problems*. This booklet is available from the US Government Printing Office, Washington, D.C. 20402 —— Stock No. 004-000-000345-4.

## REGISTRATION

To receive the full benefits of your Warranty, complete and mail the accompanying Registration Card. Also record the series and serial numbers of your equipment below. Refer to these numbers in any correspondence you have with Zenith Data Systems Corporation regarding this equipment.

Model _____     Serial # _____

Series _____     Date Purchased _____

Any attempt to alter or modify the design, or to use this device in a manner other than described in this manual, will void the Warranty and release the manufacturer from any responsibility for its operation.

# High-Performance Desktop PC
## Owner's Manual

**ZENITH** | **data systems**

THE QUALITY GOES IN BEFORE THE NAME GOES ON

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# About This Manual

The following are some visual cues you will see as you read through this manual:

## WARNING

Text set off like this indicates important information concerning a potential hazard to you. Read all warnings.

## CAUTION

Information following a caution concerns a potential problem for your equipment. Read all cautions.

Text printed with this style of type:

```
MFM-200 Monitor, Version X.X
Memory Size: XXXK [+ XXXX K]
```

is information that is displayed on the video monitor.

Keys on the keyboard are referred to by the name on the key. When an abbreviated name is on the key, it is explained the first time the key is mentioned. Names of the keys are printed with this style of type: CTRL.

# Chapter 1
# Getting Started

Your high-performance desktop PC has true supermicrocomputer performance, along with PC/AT compatibility. Some of the many standard features are:

- One megabyte RAM (random access memory)

- A 3.5-inch floppy disk drive

- A high-capacity hard disk drive

- A 31 kHz video card

- Serial and parallel communication

- An 80286 CPU that runs at 12 MHz with zero wait states

- Four expansion slots

- Real-time clock/calendar with backup battery

- System lock for security.
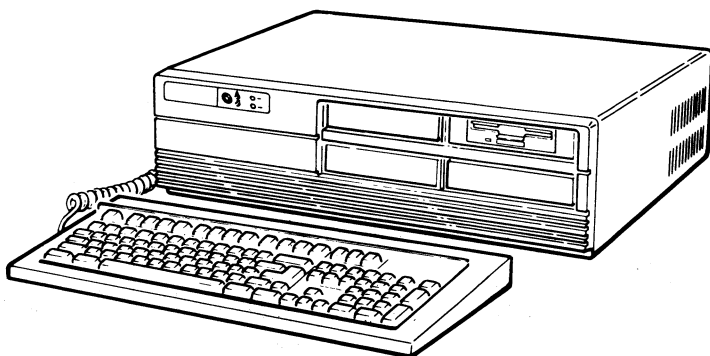


**Figure 1-1.   Your Computer**

## Getting Started

These are some of the products you can add to customize your computer:
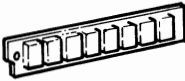
Additional plug-in memory modules

80287 or 80C287 numeric processor to speed up the handling of certain numeric data
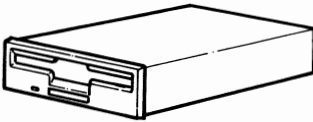
3.5-inch floppy disk drives
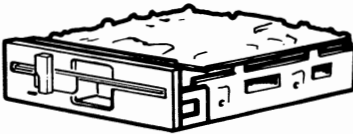
5.25-inch floppy disk drives
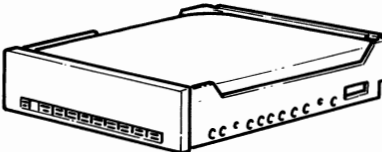
High-capacity hard disk drive.

# Setup Hints

When you unpack your computer, keyboard, monitor, and other equipment, save the cartons. Use them again if you need to ship the units.

Read and save the publications packed with your equipment. They contain valuable information.

When you set up your computer system, there are several things to consider:

•    Choose a sturdy work surface that is away from heat sources such as radiators and heaters. The ideal operating temperature is between 60° and 85° F (16° to 30° C) with a relative humidity between 10% to 80%.

•    Do not block the vents on the sides of the computer. Air circulates through them to keep the computer cool.

•    Choose a location where sunlight or bright light does not fall on the video monitor screen and cause reflections.

•    Use a properly rated and easily accessible power source for your computer. Consider using a switched power strip. That way, you can control the AC power to all your units with one switch.

# Connecting Your Equipment

For your own safety and the safety of your equipment, always take the following precautions before you make any connections:

- Make sure all power switches on your units are off.

- Verify that the computer voltage select switch is set correctly for the voltage source you are using. If you are uncertain about the power source voltage, check with the local power company.

The locations of the computer power switch and voltage select switch are shown in Figure 1-2.
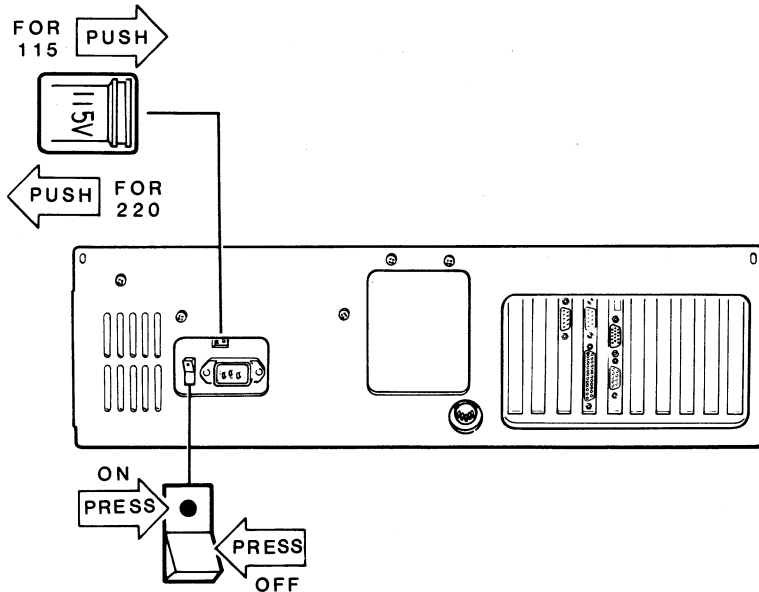


**Figure 1-2. Voltage Select and Power Switches**

Your computer has two bi-directional serial ports, a parallel port, and a video port. Figure 1-3 shows examples of devices you can connect to these ports. (There is a detailed description of the connectors and their pinout diagrams in Chapter 4.)

KEYBOARD

MOUSE

OR

AC OUTLET

OR

MODEM

PARALLEL
PRINTER

MULTIPLE
POWER
OUTLET

✱ REQUIRES SOFTWARE

RGB-TTL
MONITOR
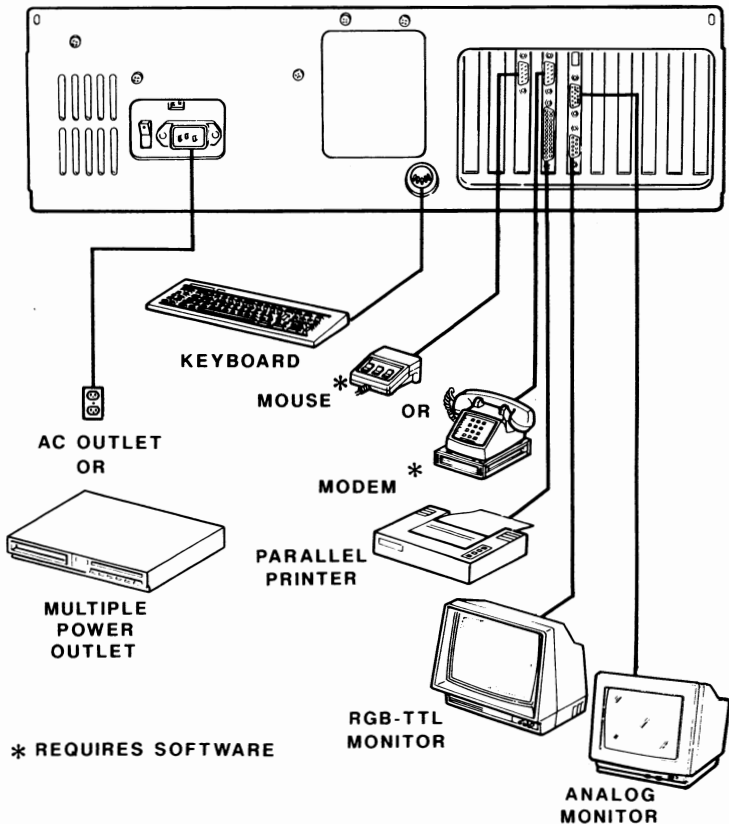
ANALOG
MONITOR

**Figure 1-3. Typical Peripherals**

## Getting Started

Your computer is set by the manufacturer to use the following types of video monitors:

*   A high-resolution analog (31.49 kHz) video monitor, such as a Zenith ZMM-149, ZCM-1390, or ZCM-1490.

*   A multi-sync video monitor.

**CAUTION**

A standard EGA (RGBrgb), CGA (RGBI or RGB), MDA (TTL monochrome), or Hercules (TTL monochrome) video monitor can be used if you change DIP switch settings and jumpers on the video card. Refer to Chapter 5 for disassembly instructions and to Chapter 4 for alternative settings. For further information on video monitor compatibility, contact your service representative.

To connect your equipment:

1.  Place the video monitor where you are going to use it. If it is convenient, you can place it on top of the computer.

2.  Connect the video cable to the video connector on the computer. Use the top 9-pin video connector for a standard TTL monochrome, RGB, RGBI, or RGBrgb color monitor. Use the bottom 15-pin connector for a 31.49 kHz analog RGB or analog monochrome monitor. Tighten the screws on the connector for a secure connection.

3.  Locate and connect the computer power cord to the computer as shown in Figure 1-4.

## Getting Started
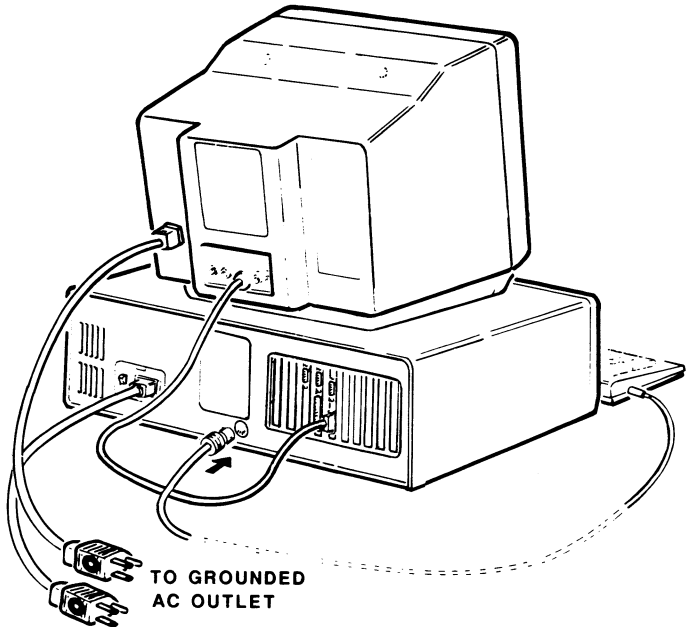


**Figure 1-4. Connecting the Video Monitor, Keyboard, and AC Power Cords**

4. Connect any peripherals, such as a printer or modem, to your computer. Refer to Chapter 4 for specific connector information.

5. Connect the keyboard cable to the computer as shown in Figure 1-4.

6. Connect the computer, video monitor, and any peripheral power cords to an AC power source.

   If you use a switched power strip, you need one with a minimum power rating of 10 amperes for 115-volt systems or 5 amperes for a 230-volt system. If you use an extension cord, use a heavy-duty, three-wire type. Smaller cords are unsafe and affect the performance of your system.

# Up and Running

Now that your equipment is connected, you can power it up. The following steps take you through the initial power-up and explain what is taking place:

1.  Some computers are shipped with an insert in the floppy disk drive. Remove this insert by pressing the eject button on the drive. (Refer to Figure 1- 5.) Save the insert to use if you transport the computer in the future. If your computer does not have a shipping insert, it has an automatic protection feature built in.
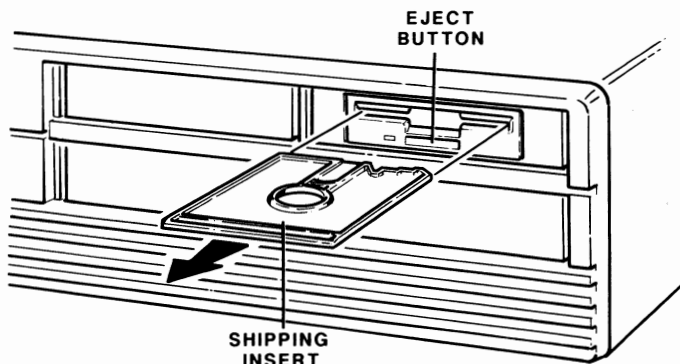


**Figure 1-5.  Removing a Shipping Insert**

2.  Turn on the power to your computer system by one of the following methods:

    Turn on the video monitor, then the computer, then any other peripherals (printer, modem, etc.).

    If your units are connected to a switched power strip, make sure all power switches are on. Then turn on the power control switch on the power strip or box.

When you turn on the power to your system, the computer checks major circuits and functions. A diagnostic message is displayed if a problem is found. (Chapter 6 has information on these messages.)

As these checks are made, you can hear a cooling fan and the floppy disk drive heads move. The floppy disk drive and the hard disk drive LEDs alternately glow and the keyboard LEDs blink. Shortly, you see the following message on the video monitor screen:

```
No bootable partitions
```

This message means you need to format the hard disk drive and install the operating system.

To prepare the hard disk drive and install the operating system:

1.  Refer to Figure 1-6. Press the CTRL (control), ALT (alternate) and INS (insert) keys in sequence. Hold them down briefly, then release them. This is what is known as a "soft" or "warm" reset.

    The computer goes to the built-in Monitor program. You will see this message on your video monitor:

    ```
    MFM-200 Monitor, Version x.xx
    Memory Size: xxx K [+ xxxxK]

    Enter "?" for help.
    ->
    ```



Ctrl  Alt                                    Ins
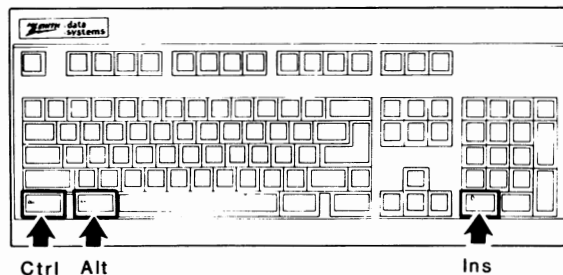
**Figure 1-6.  Resetting to the Monitor Program**

## Getting Started

2.  Locate the disk packed with the operating system documenta-
    tion. This disk has the operating system and a setup program
    on it which you can "load" into the computer.

3.  Refer to Figure 1-7 and insert this disk, label side up and
    toward you, into floppy disk drive A. Slide the disk all the way
    into the drive until you hear a click and the eject button pops
    out.
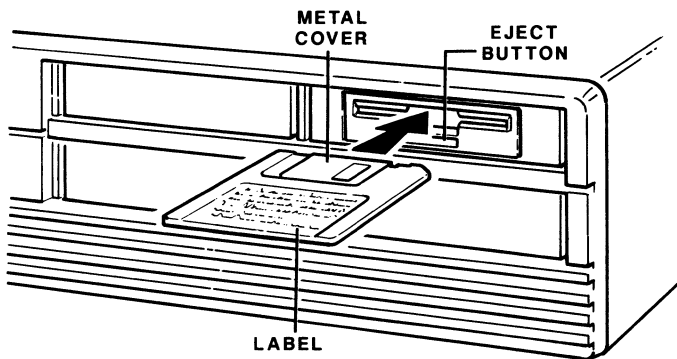


**Figure 1-7. Inserting a Disk**

4.  Press the B key, the F key, and then press ENTER. Typing B
    and F tells the computer to "Boot from the Floppy drive."
    Pressing ENTER tells the computer to carry out the command.

    The disk drive LED lights and the floppy disk buzzes as the
    computer loads the data from the disk into memory.

5.  Read the messages displayed on the screen and reply to the
    requests for information. If you make a typing mistake, back-
    space to erase the entry. Then retype your entry.

Refer to the operating system publications for guidance as you go
through the initial setup of your computer. Then read Chapter 2 of
this manual for useful information about using your computer.

# Using Your Computer

Now that you have your system up and running, take some time and read through this chapter. It has useful information about the keyboard and disk drives. The use and care of floppy and hard disks are also described.

## Keyboard

The keyboard is arranged so the keys are convenient to use for all types of entries. Basically, they are grouped by use. For example, the keys that move the cursor up, down, or sideways are arranged so you can quickly move the cursor. The numeric keys are arranged like a calculator keypad so numeric data is easy to enter. Other keys are arranged like those on a typewriter. Some keys can be programmed for unique functions.

Most keys will automatically repeat as long as you hold them down. This feature is useful with keys that move the cursor, like the DEL (delete) key, the ENTER/RETURN key, the space bar, and the arrow keys. The only keys that do not repeat automatically are the SHIFT, CTRL (control), ALT (alternate), CAPS LOCK, SCROLL LOCK, and NUM LOCK (number lock).

All keys except the SHIFT, CTRL, and ALT keys make a clicking sound. This sound can be turned off (or back on) by pressing and holding the ALT key, then pressing the tilde (~) key, and then releasing them.

The following pages describe unique keys and special uses of familiar keys.

Using Your Computer

## Alphanumeric Keys

Many of the alphanumeric keys are the same as on a typewriter keyboard. The letter, number, punctuation mark, and symbol keys are arranged like a typewriter keyboard as shown in Figure 2-1. To help touch typists keep their fingers on the proper keys, the F and J keys have a raised dot.
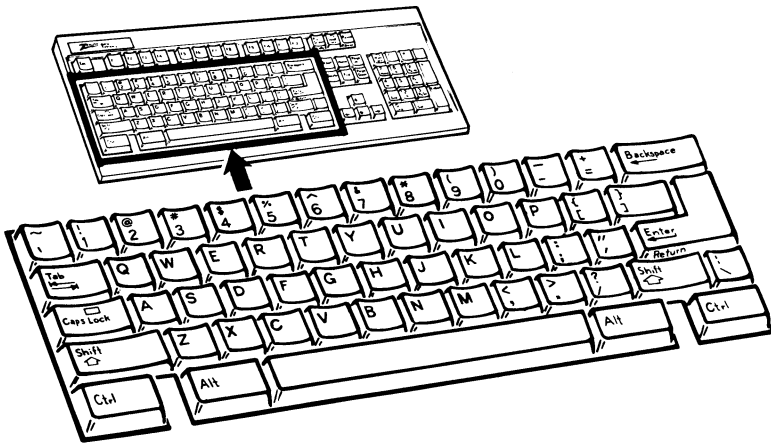


**Figure 2-1. Alphanumeric, Modifier, and Special Keys**

Most of these keys also perform like typewriter keys. When a number, letter, punctuation mark, or symbol key is pressed, that character appears on the screen.

Other keys (BACKSPACE, space bar, and TAB), when programmed by software, perform quite differently from typewriter keys. For example, the shift keys affect some keys, but not others.

There are also some alphanumeric keys that are unique to computers. The two modifier keys, CTRL (control) and ALT (alternate), are normally used with other keys. The CAPS LOCK key acts like a typewriter shift lock key, and the ENTER/RETURN key acts like a typewriter carriage return key.

## Using Your Computer

Two other important differences between a typewriter keyboard and your computer keyboard are:

- The computer reacts differently to the number 1 and the lower case letter I. Be sure you do not type the letter I when you mean the number 1.

- The number 0 (zero) and a capital letter O may look alike, but they have different meanings to the computer. Many computers display the number 0 with a diagonal line through it. Make sure you type the correct character.

**Shift** — There are two SHIFT keys on the keyboard; one on the right side of the keyboard and one on the left. Pressing SHIFT generates capital letters, symbols, and alternate punctuation marks. However, if the CAPS LOCK is engaged, pressing a SHIFT key causes the letter keys to generate lowercase letters. In some software packages, the SHIFT keys are also used in combination with other keys to enter commands. Refer to your software documentation for special uses.

**Caps Lock** — This is similar to a typewriter shift lock key: press it once to begin typing capital letters, press it again to stop typing capital letters. The difference is that CAPS LOCK only affects the letter keys. You still need to press either the right or left SHIFT key to change the top row of numbers into special symbols (!, @, #, etc.) and to engage the alternate punctuation marks and symbols ({, :, ?, <, etc.). A light on the key is lit when CAPS LOCK is engaged.

**Enter/Return** — This key returns the cursor to the left side of the display. Software usually moves the cursor to the next line. Pressing the ENTER/RETURN key after data or instructions have been entered tells the computer to process them.

**Tab** — This key moves the cursor to the next tab setting. Many software programs allow you to change the tab settings. Your software documentation will give you specific instructions on setting tabs.

## Using Your Computer

**Space Bar** —— Usually, when you press the space bar, it enters a blank character (space). The space bar is also used with some software to move the cursor around the screen or to change the text on the screen. For example, in the Hardware Setup/Configuration Program, you press the space bar to view information about different types of hard disk drives. Special uses of the space bar are discussed in your software documentation.

**Backspace** —— This key moves the cursor one space to the left and usually erases any characters in the cursor's path. Special uses of the BACKSPACE key are discussed in your software documentation.

**Ctrl (Control)** —— There are two CTRL keys on the keyboard, one on the right and one on the left. This key is one of the main keys for entering commands. Customarily, you press and hold the CTRL key, and then press another key. The CTRL key is often symbolized by a caret (^). For example, if you see ^K, you would press and hold the CTRL key, then press the K key, then release both keys. Some commonly used control key combinations are:

> CTRL-S —— The output on the screen pauses until you press another key.

> CTRL-C —— Any operating system program that is in progress is halted and the operating system prompt appears or if you are running a Monitor program, the Monitor prompt appears.

> CTRL-ALT-DEL —— The computer resets, starts the power-up self-tests, and either autoboots or enters the Monitor program.

> CTRL-ALT-INS —— The computer enters the Monitor program.

**Alt (Alternate)** —— There are two ALT keys on the keyboard, one on the right and one on the left. The ALT key is similar in operation to the CTRL key. It is used with other keys to enter commands. Usually, the command entered using ALT and another key is programmed by software. Your software documentation will discuss particular uses of the ALT key.

## Numeric Keys

The numeric keys, shown in Figure 2-2, have many of the same keys as a calculator keypad. The numbers keys are arranged like a calculator so numeric data can be entered rapidly if NUM LOCK is on or either SHIFT key is pressed. NUM LOCK is automatically on when the computer is first powered up or reset.

These keys do not perform like calculator keys since they cannot perform calculations unless programmed by software. When NUM LOCK is not engaged, the keys perform like the other cursor control (arrow) keys on the keyboard.
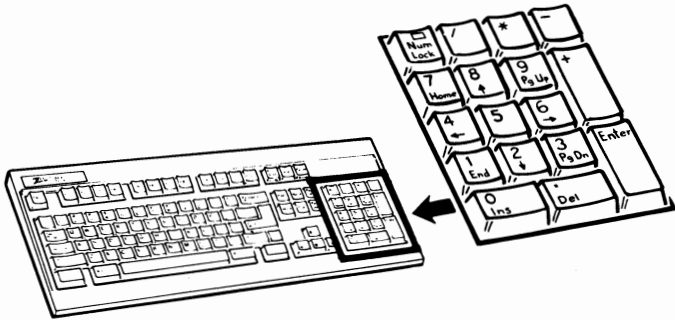


**Figure 2-2. Numeric Keypad**

When NUM LOCK is on, a small light on the key is lit. This indicates that the numeric keypad is ready to be used for data entry. To turn NUM LOCK off, press the key. The numeric keypad then can be used for control functions. NUM LOCK is active when you first turn the computer on or if you reset it.

Using Your Computer

## Control Keypad

The functions of the control keys are determined by software. The operating system and other software packages, such as word processors and spreadsheets, program these keys to perform particular functions. Your software documentation will provide information on the use of each key shown in Figure 2-3.

**Figure 2-3.    Control Keypad**

A few older software programs may not allow all of the functions to be performed using the separate control keypad. If you are running such a program, it may be necessary to use the corresponding keys in the numeric keypad section of the keyboard.

Here are some examples of the operations these keys perform:

**Print Screen/SysRq (System Request)** — When the PRINT SCREEN key is pressed, whatever is on the screen will be sent to the printer to be printed. This key is particularly useful when you run operating system commands like DIR and TYPE and want to have a paper copy of the information. If your printer is turned off, not on-line, or out of paper, the computer pauses for about 10 seconds. If the printer is still not ready at the end of this time, the computer ignores the command.

## Using Your Computer

When used with the ALT key, SYS RQ performs similarly to the BREAK key. Various software programs use it to return to the operating system. Your software documentation provides specific information on the use of this function.

**Scroll Lock** — When you press the SCROLL LOCK key, a small red light on the key lights. This indicates that the SCROLL LOCK feature is on. Press the key again to turn SCROLL LOCK off. Some spread-sheets use SCROLL LOCK to keep the cursor on the same screen line while moving the whole spreadsheet.

**Pause/Break** — The PAUSE/BREAK key is used to engage either one of two features — pause or break. The pause feature freezes the display of text on the screen and is engaged by pressing the PAUSE/BREAK key. For example, if you enter an MS-DOS® TYPE command, the text scrolls up the screen faster than you can read it. Pressing the PAUSE key will stop the display temporarily. Pause can be canceled by pressing any other key.

The break feature is engaged by pressing the CTRL key and the PAUSE/BREAK key in combination. BREAK is generally used with operating system commands. In some systems the break feature halts programs as they are running. For example, if you begin a MS-DOS DISKCOPY routine, then realize that you cannot find the disk you want to copy, you can use the break feature to return to the operating system prompt. BREAK is also useful for stopping TYPE commands.

**Delete (Del)** — When pressed at the same time as the CTRL and ALT keys, the DELETE key causes the computer to reset. Many software packages also use this key to erase individual characters, words, or whole documents. The DEL key on the numeric keypad performs the same functions.

**Insert (Ins)** — When pressed at the same time as the CTRL and ALT keys, the INSERT key calls up the Monitor program. Since the computer is not actually reset, you can boot an alternate drive using Monitor commands. This key allows you to enter an insert mode, where some software packages allow text or commands to be inserted. The INS key on the numeric keypad performs the same functions.

## Using Your Computer

**Home** — In many software programs, pressing the HOME key moves the key to the upper-left corner of the screen. Some word processing programs use the HOME key to move the cursor to the beginning of the current line. With spreadsheet programs, pressing the HOME key usually moves the active cell indicator to the upper-left corner of the spreadsheet. The HOME key on the numeric keypad performs the same functions.

**End** — Pressing the END key typically moves the cursor to the lower-left corner of the screen. With some word processing programs, the END key moves the cursor to the end of the current line. Many spreadsheets use the END key to move the active cell indicator to the most remote cell. The END key on the numeric keypad performs the same functions.

**Page Up (PgUp) and Page Down (PgDn)** — The PAGE UP and PAGE DOWN keys move the cursor some set number of lines upward or downward. The PGUP and PGDN keys on the numeric keypad perform the same functions.

## Cursor Control Keys

Figure 2-4 shows the cursor control keys. The arrows indicate the direction in which they move the cursor. The Hardware Setup/ Configuration Program uses these keys to move the highlight from one field to the next. They can be used with word processing software to move the cursor for typing and positioning text. With many spreadsheets, these keys move the active cell in the direction they point.
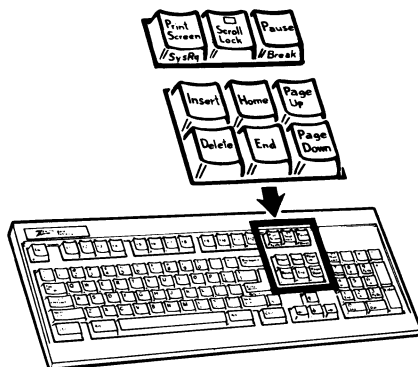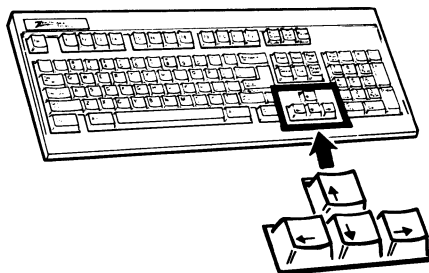


**Figure 2-4. Cursor Control Keys**

A few older software programs may not allow all the functions to be performed using a separate cursor control keypad. If you are running one of these applications programs, it may be necessary to use the corresponding keys in the numeric keypad section of the keyboard.

## Function Keys

The thirteen function keys are located in a row above the alphanumeric keyboard, as shown in Figure 2-5. They are labeled F1 through F12 and ESC. The operation of these keys is different with each software program. In some applications, these keys have no effect on the operation of the computer.
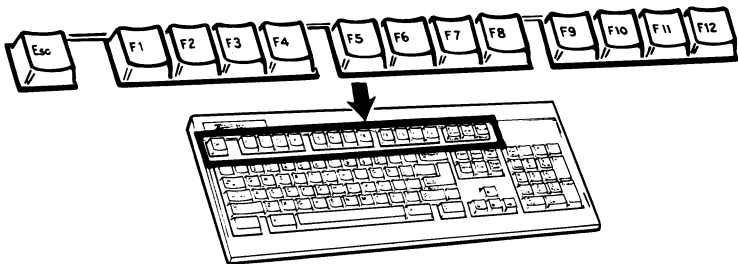


**Figure 2-5. Function Keys**

**Esc** — This is the escape key. It is commonly used to stop the execution of a program. The ESC key also performs special functions when used in combination with another key in some programs.

**F1-F12** — These function keys are used for special purposes by software packages. For example, in some word processing programs, the function keys perform such functions as indenting, setting right and left margins, underlining, and boldfacing type. The function keys have special capabilities in the MS-DOS operating system. For example, the function key F1 allows you to use all or part of a previously-entered command. In some applications, the F11 and F12 function keys may not perform any functions. Your software documentation provides specific information about the use of the function keys.

## Using Your Computer

### Adjusting the Keyboard Angle

To adjust the angle of the keyboard so it is comfortable for typing, you can move two legs on the bottom of the keyboard.

To increase the angle, pull the legs out.        PULL FOR
                                                 MORE TILT
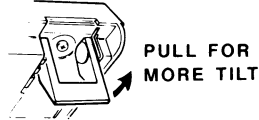
To decrease the angle, push each leg        PUSH FOR
closed. The keyboard has less tilt.         LESS TILT
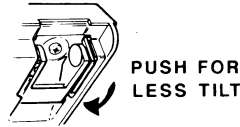
### AT/XT-Compatibility

Your keyboard and computer are AT-compatible. However, you can use the keyboard with an XT-compatible computer if the computer has the proper firmware.

To switch the keyboard from AT-compatibility to XT-compatibility, gently pry up the nameplate on the keyboard with a flat-bladed screwdriver or similar tool. Remove the nameplate and move the switch to the XT position, as shown in Figure 2-6. Then replace the nameplate.
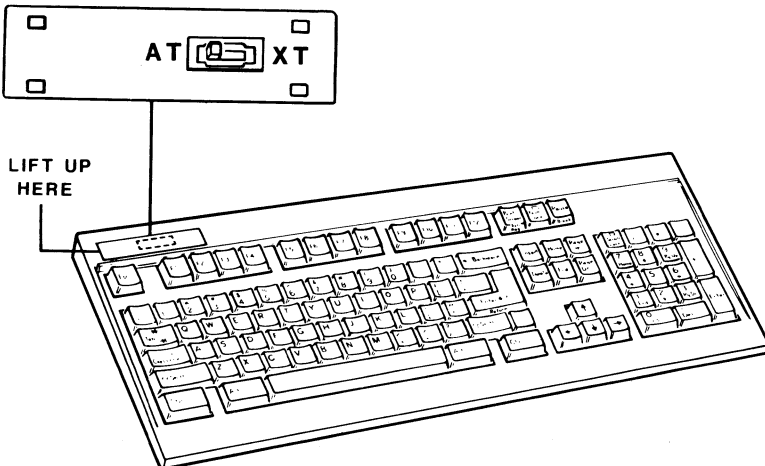
**Figure 2-6.   AT/XT-Compatibility**

Using Your Computer

# Disk Drives

Computers use disk drives to transfer programs and data between memory and disks. Your computer has a floppy disk drive and a hard disk drive. The first floppy disk drive is commonly referred to as drive A. The first hard disk drive is usually referred to as drive C.

Often, it is efficient to divide (partition) a hard disk drive so you can store different types of information on different partitions. This is done using the operating system. The partitions are then referred to as drives C, D, E, and F. Your operating system provides specific information on partitioning and naming hard disk drives.
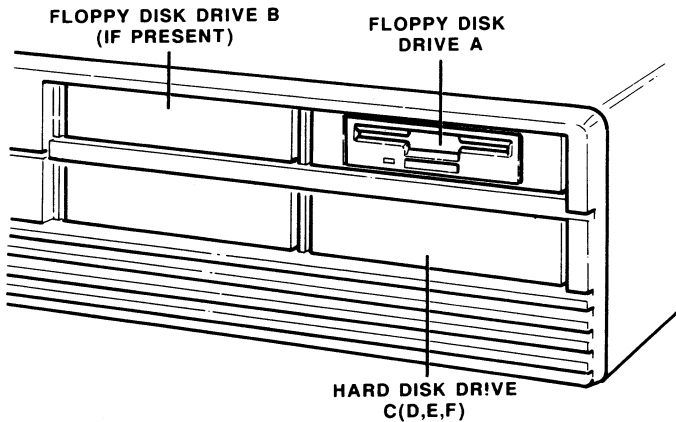


**Figure 2-7. Disk Drive Locations and Names**

Using Your Computer

# Floppy Disk Drive

The floppy disk drive transfers programs and data from floppy disks to the temporary computer memory called RAM (random access memory). When you first set up your computer system, the operating system is on a floppy disk which you load into RAM. When you turn your computer off, it does not retain this data. This is why it is necessary to store the data on either a floppy disk or a hard disk. The 3.5-inch floppy disk drive in your computer uses 3.5-inch double-sided, high-density disks which store up to 1.4 megabytes of data. (A megabyte is 1024 kilobytes.)

When information is stored on floppy disks, it can be transferred between one computer and another. Floppy disks are also used to backup data from a hard disk drive.

Figure 2-8 shows a typical floppy disk drive.
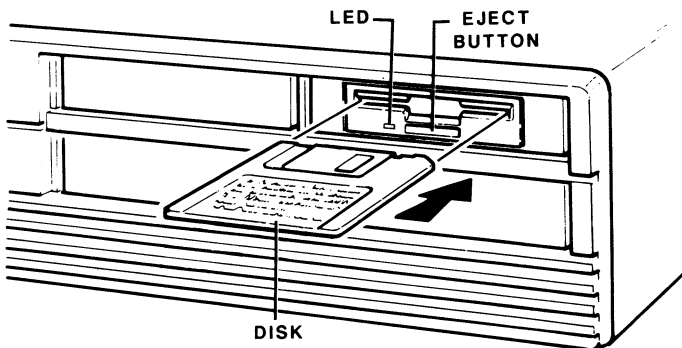


**Figure 2-8. Floppy Disk Drive**

## Using Your Computer

**Inserting Floppy Disks** —— To insert a floppy disk into the floppy drive, hold the disk with the label side up and toward you. Then slide the disk into the disk load slot until you hear a click and the eject button pops out. If the disk does not slide in easily, check to be sure that nothing is interfering with the disk. Check the disk label and the drive.

The LED (light-emitting diode) on the drive lights whenever the drive is reading data from or writing data to the floppy disk.

**Removing Floppy Disks** —— To remove a disk, press the eject button. The disk will partially pop out. When you remove the disk, a door flips down. This prevents dust from getting into the drive when it is not in use. The eject button will stay pressed in until you insert another floppy disk into the drive.

Using Your Computer

# Hard Disk Drive

The high-capacity hard disk drive in your computer lets you per-
manently store 20 megabytes or more of data. Since this data is
"on-line," it is fast, convenient, and easily accessible. Hard disk
drives are sometimes referred to as a rigid disk drive or a
Winchester drive.

The LED (light-emitting diode) on the front cover by the keylock
lights whenever the drive is reading data from or writing data to the
hard disk.
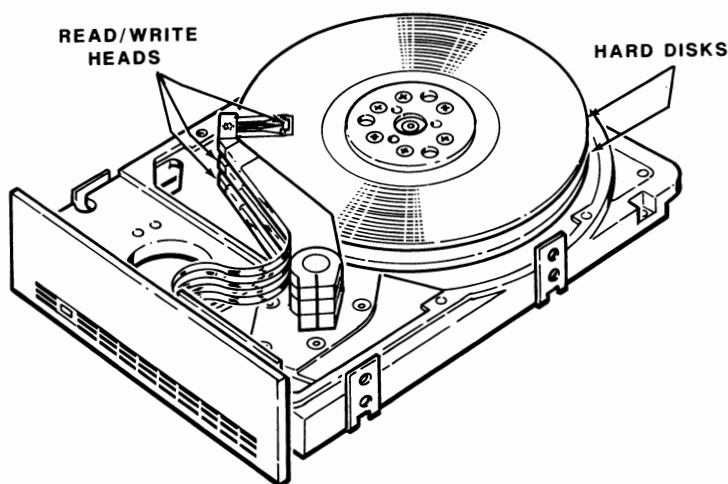
**Figure 2-9.   Hard Disk Drive**

# Disks

The information you work with when you use your computer  is stored on either a hard disk or a floppy disk.  This information can be the operating system, an application program, or the data you create.  Data can be read from the disk or written to the disk.

# Floppy Disks

Your computer uses double-sided, high-density, 3.5-inch micro floppy disks.  These disks can store 1.4 megabytes of data. Although floppy disks are quite durable, they do require some care.

Keep disks dry.
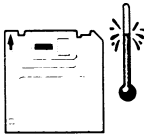
Keep disks away from extreme temperatures.
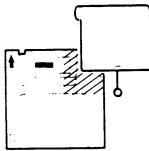
Keep disks out of direct sunlight and away from other heat sources, such as radiators or heaters.
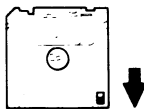
Write-protect disks that contain valuable programs or data.

## Using Your Computer
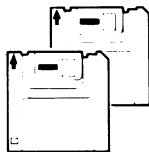
Make backup copies of valuable disks.

Label disks so you know what information is on them.
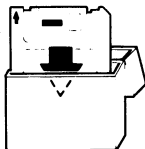
Keep disks clean and safe by storing them in a disk storage container.
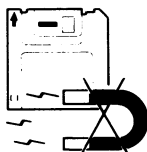
Keep disks away from magnetic fields and things that contain magnets (like some telephones). Magnetic fields can scramble the information on a disk or destroy it.
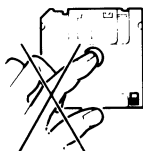
Only touch the plastic housing on disks. Do not expose or touch the floppy disk surface. Avoid touching the hub on the bottom of the disks.

## Writing-Protecting Disks

When a disk is write-protected, you cannot add new information to it or change any information on the disk. You can only "read" the information.

It is a good idea to write-protect operating system disks and application program disks. Disks with valuable data should also be write-protected. Some application program disks are permanently write-protected.

To write-protect a disk, slide the tab on the bottom of the disk toward the corner. Refer to Figure 2-10.

If you want to use the disk to store information, you can remove the write-protection. To unprotect the disk, slide the tab away from the corner.



NOT WRITE-PROTECTED
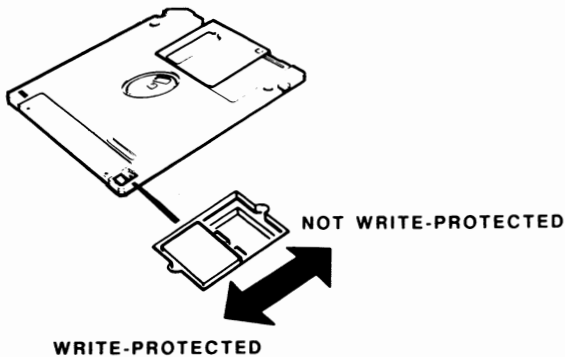
WRITE-PROTECTED

**Figure 2-10.   Write-Protecting a Disk**

Using Your Computer

## Formatting Disks

Before you can use new floppy disks to store information, you need to format (prepare) them. Use the operating system to format a disk. The operating system documentation has the instructions. (If you are using MS-DOS® or MS-OS/2®, refer to the FORMAT command.)

Any disk that is not write-protected can be formatted. However, formatting destroys any data already on the disk.

## Organizing Data on Disks

Typically, disks store three types of information:

• An operating system to "manage" the computer.

• Application programs, such as wordprocessing, spreadsheets, and graphic programs.

• Data you create using an application program.

You need to load the operating system into your computer before you can load and use any information on a disk.

Many application program disks allow enough space on the disk for you to add the operating system. Combining the application program and the operating system on one disk makes the disk bootable and more convenient to use.

# The Monitor Program

Your computer has a built-in program called the Monitor program. This program is stored in a ROM (read-only memory) IC on the main circuit card. It is referred to as "firmware" because it is part of the computer hardware and cannot be changed from the keyboard. These are some of the highlights of the Monitor program:

- A Hardware Setup/Configuration Program. Data that is essential for the operation of your computer can be readily entered using the keyboard.

- Power-up tests which test various circuits each time the computer is turned on.

- Boot command which allows booting from any drive.

- Extensive tests selected from the keyboard for checking disk drives, keyboard, base memory, and extended memory.

- Video/scroll mode selections for various video monitor/video card combinations.

- A color bar pattern for adjusting video monitor displays.

- Commands designed for experienced programmers to enter, change, examine, and run machine language programs.

The Monitor Program

# The Monitor Prompt and Command Summary

To access the Monitor program, press and hold the CTRL (control) and ALT (alternate) keys, then press the INSERT key. After a short delay, you will see the following three-line message displayed on your video monitor:

```
MFM-200 Monitor, Version X.XX
Memory Size: XXX K [+ XXXX K]
Enter "?" for help.
->
```

The arrow (->) pointing to the blinking cursor is the Monitor prompt which shows that you have reached the Monitor program.

If you press the ? (question mark) key and press ENTER at the Monitor prompt (->), you will see a summary of the Monitor commands similar to the one shown below. The corresponding syntax for each Monitor command simply means the order or way to enter the command so that the computer recognizes it.

```
                  - MFM-200 Command Summary -

CMD:    Explanation             Syntax
----    -----------             ------
?:      Help                    ?
B:      Boot from disk          B [{F|W}][{0|1|2|3}][:<partition>]
C:      Color bar               C
D:      Display memory          D [<range>]
E:      Examine memory          E <addr>
F:      Fill memory             F <range>,{<byte>|"<string>"}...
G:      Execute (Go)            G [=<addr>][,<breakpoint>]...
H:      Hex math                H <number1>,<number2>
I:      Input from port         I <port>
M:      Move memory block       M <range>,<dest>
O:      Output to port          O <port>,<value>
R:      Examine Registers       R [<register>]
S:      Search memory           S <range>,{<byte>|"<string>"}...
T:      Trace program           T [<count>]
U:      Unassemble program      U [<range>]
V:      Set Video/Scroll        V [M<mode>][S<scroll>][100][200]
        Where <range> is:       <addr>{,<addr>|L<length>}
TEST:   Extended diagnostics    TEST
SETUP:  Define hardware Setup    SETUP
           Copyright (C) 1987, by Zenith Data Systems
->
```

# Entering Monitor Commands

Use the following rules when you enter Monitor program commands:

•   Items shown in brackets

[*like this*]

are optional entries and only need to be entered in certain cases.

•   Items shown in braces and separated by a vertical bar

{*like this* | *and this*}

represent a series of choices.  Choose only one.  For example, for the items shown above you would enter either *like this* or *and this*.

•   Items shown in angle braces

<*like this*>

should be replaced with the variable (address, mode number, etc.) you have selected.

•   Ellipses (...) indicate that you can enter additional material similar to that preceding the ellipses.

## The Monitor Program

# Monitor Setup Command

The last command shown on the MFM-200 Monitor Command Summary is SETUP. Use this command to reach the Monitor Hardware Setup/Configuration Program.   This program stores information essential for the operation of your computer, such as:

• Time and date
• Amount of memory and how the memory is allocated
• Number and types of floppy disk drives
• Drive you want to boot from
• Type of video display
• Video refresh rate
• Operating speed
• Number and types of hard disk drives.

To reach the Hardware Setup/Configuration Program, type the word SETUP after the Monitor prompt (->) and press ENTER.

```
              Z-200 Hardware Setup/Configuration Program

Time:      09:53:08                 Operating Speed:   Slow Fast Smart
Date:   04/14/1988
                                    Hard Disk Drive 0:
            Base Extended EMS
  Main RAM:     640K      0K   256K         Media Type:
Add-On RAM:       0K      0K   ---
     Total:     640K      0K   ---   Cylinders:      Heads:
                                     Ship Zone:      Sectors:
Floppy Drive 0:         3-1/2" 1.4M  Precomp:        Capacity:
Floppy Drive 1:      -None Present-

Boot Drive:   Floppy Then Hard Disk  Hard Disk Drive 1:   -Not Present-


Serial Port 1 (COM1):      Enable           Media Type: N/A
Serial Port 2 (COM2):      Enable
                                     Cylinders:      Heads:
Video Display:    Enhanced Graphics  Ship Zone:      Sectors:
                                     Precomp:        Capacity:
Video Refresh Rate:   50 Hz   60 Hz
```

**Figure 3-1.    Hardware Setup/Configuration Program**

The Hardware Setup/Configuration Program menu, similar to the one shown in Figure 3-1, appears. Some of the information is highlighted in rectangular boxes called "fields." These fields contain information about your computer. If you add or change memory specifications, drives, video options, or change backup batteries, the entries need to be adjusted. Check that these fields reflect your present computer hardware. A description of each entry follows.

**Time and Date** —— The computer's clock and calendar run continuously, even when the computer is turned off. There is a battery backup. After you initially verify these entries, the only time you need to enter the time and date information is when you replace the backup battery or compensate for daylight saving time changes.

When the Hardware Setup/Configuration Program is first displayed, the Time field is highlighted in the upper left corner and a blinking cursor is under the first number to right of the field.

Your computer keeps track of time using a twenty-four hour clock, in hours (00 - 24), minutes (00 - 59), and seconds (00 - 59). Type in the time of day using this format, then press ENTER. For example, to enter 8:35 am, type 083500; to enter 8:35 pm, type 203500. The computer automatically adds the semicolons (:) to separate the hours from the minutes and seconds.

If you make a mistake while typing, use the BACKSPACE key to erase the incorrect entry, type it again, and then press ENTER.

The highlight now moves to the Date field. Your computer keeps track of the date using months (01 - 12), days (01 - 31), and years. Type in the date using this format. Then press ENTER. For example, to set the calendar for January 5, 1988, type 01051988 The computer automatically adds the slashes (/) to separate the month from the day and year.

## The Monitor Program

You can now change any other entries to reflect your system or you can exit the program. In the remaining fields, use these keys:

- The arrow keys to move from one field to another.

- The spacebar and BACKSPACE keys to make a selection.

- The ESC (escape) key to exit from the program when you are finished.

```
┌─────────────────────────────────────┐
│         Z-200 Hardware Setup/        │
│ ┌─────────────────────────────────┐  │
│ │ Time:      09:53:08             │  │
│ │ Date:   04/14/1988              │  │
│ │                                 │  │
│ │             Base Extended EMS   │  │
│ │   Main RAM:     640K    0K 256K │  │
│ │   Add-On RAM:     0K    0K  --- │  │
│ │       Total:    640K    0K  --- │  │
│ │                                 │  │
│ │ Floppy Drive 0:     3-1/2" 1.4M │  │
│ │ Floppy Drive 1:     -None Present- │
│ │                                 │  │
│ │ Boot Drive:  Floppy Then Hard Disk │
│ │                                 │  │
│ │ Serial Port 1 (COM1):     Enable │ │
│ │ Serial Port 2 (COM2):     Enable │ │
│ │                                 │  │
│ │ Video Display:   Enhanced Graphics │
│ │                                 │  │
│ │ Video Refresh Rate:  50 Hz  60 Hz │ │
│ └─────────────────────────────────┘  │
└─────────────────────────────────────┘
```

See Table 3-1 which follows.

5-1/4" 360K
5-1/4" 1.2M
3-1/2" 720K
3-1/2" 1.4M
-None Present-

Floppy Drive 0
Hard Disk Drive 0
Floppy Then Hard Disk
Enter MFM-200 Monitor

Color Card: 40 x 25
Color Card  80 x 25
Mono. Card: 80 x 25
Enhanced Graphics

**Figure 3-2.   Hardware Setup/Configuration Program Choices**

## The Monitor Program

**Main RAM/Add-On RAM** — As you can see in Figure 3-2 and Table 3-1 which follows, there are several ways you can allocate the memory on the main board. You can designate base memory and assign the balance of the memory as EMS (expanded memory specification) or extended memory.

• Base memory refers to the first 256K/512K/640K of memory that DOS recognizes. Most application programs let DOS manage their memory.

• Expanded memory (EMS) is a special kind of memory that goes beyond DOS's 640K limit. It is not addressed like normal memory. Instead application programs use an EMS software driver to communicate with this memory. Zenith Data Systems supplies utility programs that use this memory. Refer to MS-DOS EMM.SYS command for further details. Spread-sheets, databases, and other memory-intensive functions require more than the DOS limit of 640K. These application programs are designed to use EMS memory with other operating systems. (EMS is located at 0D0000 to 0DFFFF.)

• Extended memory is the amount of memory beyond 1 megabyte that is outside the memory that DOS can access. Recent application programs can now access this protected mode memory. Utilities such as ZCACHE.SYS and VDISK.SYS use this memory. Refer to your MS-DOS documentation for details.

The Main RAM field reflects the amount of memory on the main board and how the memory is to be used.

The Add-On RAM reflects the use of memory of any optional memory cards (not including SIMMs on the main board).

The Total designates all the memory in your system that is dedi-cated as Base memory or Extended memory. This figure is automatically calculated.

## The Monitor Program

The following table shows the fields you see for the Main RAM entry. You can choose any one of the entries that are standard. Other entries require additional memory (Z-605-1 SIMM module upgrade) or a custom PAL IC.

**Table 3.1.   RAM Memory Designations**

| BASE | EXTENDED | EMS | COMMENTS |
|------|----------|-----|----------|
| 256K | 0K | 384K | Requires custom PAL |
| 256K | 0K | -OFF- | Requires custom PAL |
| 512K | 0K | 384K | Standard |
| 512K | 0K | -OFF- | Standard |
| 640K | 0K | 256K | Standard* |
| 640K | 0K | -OFF- | Standard |
| 640K | 0K | 2048K | Requires optional Z-605-1 |
| 640K | 2048K | -OFF- | Requires optional Z-605-1 |
| 640K | 3072K | 2048K | Requires 3 optional Z-605-1 |
| 640K | 5120K | -OFF- | Requires 3 optional Z-605-1 |
| 640K | 5120K | 2048K | |
| 640K | 7168K | -OFF- | |
| 640K | 7168K | 2048K | Options for these fields |
| 640K | 9261K | -OFF- | presently not available |
| 640K | 13321K | 2048K | |
| 640K | 15232K | -OFF- | |

*Initial setting by manufacturer.

## The Monitor Program

**Floppy Drive 0/Floppy Drive 1** — You can install two floppy drives in your computer. Drive A is referenced in the Floppy Drive 0 field. Drive B is referenced in the Floppy Drive 1 field. The following choices are available:

5-1/4" 360K      5.25-inch, 360 kilobyte, standard-density floppy disk drive

5-1/4" 1.2M      5.25-inch, 1.2 megabyte, high-density floppy disk drive

3-1/2" 720K      3.5-inch, 720 kilobyte, high-density floppy disk drive

3-1/2" 1.4M      3.5-inch, 1.4 megabyte, high-density floppy disk drive

Not Present      Indicates that no floppy disk drive is installed

The settings for your computer when it is shipped from the manufacturer are:

Floppy Drive 0:   3-1/2" 1.4M
Floppy Drive 1:   Not Present

**Serial Port 1 (COM1)/Serial Port 2 (COM2)** — Both serial ports on your computer are initially set by the manufacturer as Enabled. If you add a circuit card, modem, or other device that requires a COM1 or COM2 port, you need to change the Hardware Setup/Configuration field for the initial COM1 or COM2 port to Disable. The new serial port can then be recognized as COM1 or COM2.

## The Monitor Program

**Boot Drive** —— In this field you select the drive you want your computer to boot from when it autoboots. These are the selections available:

Floppy Drive 0                    Instructs the computer to load the operating system from floppy disk drive A.

Hard Disk Drive 0                 Instructs the computer to load the operating system from hard disk drive C.

Floppy then Hard Disk             Instructs the computer to load the operating system from floppy disk drive A if it is ready. If drive A is not ready, the computer then tries to load the operating system from the hard disk drive.

Enter MFM-200 Monitor             Instructs the computer to go to the Monitor program instead of loading the operating system.

When your computer is shipped from the manufacturer, this field reads Floppy Then Hard Disk.

**Video Display** —— The video card in your computer is capable of controlling analog, standard EGA, CGA, multi-sync, and monochrome video monitors. This Video Display field lets you choose the type of display the video card produces. You can make the following choices:

Color Card: 40x25                 Displays text at 40 characters per line, 25 lines per screen.

Color Card: 80x25                 Displays text at 80 characters per line, 25 lines per screen.

Mono Card: 80x25                  Displays a high-resolution monochrome display.

## The Monitor Program

Enhanced Graphics          Displays an EGA, VGA, or high-
resolution analog display. This is the
initial setting from the manufacturer.

**Video Refresh Rate** — This field reflects the power line frequency
in your area. In the United States, the typical power line frequency
is 60 Hz. In Europe, the typical power line frequency is 50 Hz. If
your system is set for the wrong frequency, the display will flicker.
The manufacturer setting for this is 60 Hz.

**Operating Speed** — This field reflects the operating speed.
Normally the Fast mode is used. However, there are some pro-
grams that require a slower input/output speed in order to run. The
Smart mode slows the computer down for the floppy disk opera-
tions, but allows the fast speed for other operations. If a program
does not run properly in either the Fast or Smart mode, you can
slow down the complete operation of the computer by choosing the
Slow mode. The Fast mode is the manufacturer setting.

**Hard Disk Drive 0/Hard Disk Drive 1** — Your system can support
up to two hard disk drives. A drive type ID code for your hard disk
drive is on a label on the back of the computer. Use it along with
the information from Table 3-2 to determine the correct drive type.
Enter the drive type number (not the drive type ID code).

### Table 3-2.   Hard Disk Drive Types

| DRIVE TYPE ID CODE | DRIVE TYPE | MANUFACTURER/ MODEL NO. | DRIVE DESCRIPTION | FORMATTED SIZE |
| --- | --- | --- | --- | --- |
| 1021 | 37 | Seagate ST-251-1 | 40M, 5-1/4 half-height | 42.8M |
| 1020 | 41 | MicroScience HH-1050 | 40M, 5-1/4 half-height | 44.6M |
| 1013 | 43 | CDC 94205-51 | 40M, 5-1/4 half-height | 43M |
| 1011 | 39 | CDC 94155-86 | 80M, 5-1/4 half-height | 72.5M |

## The Monitor Program

When you enter the drive type number, the information about your drive is displayed. If you install a drive that is not listed in the table, refer to the documentation for the drive. You may be able to step through the drive types on the menu and match the specifications. Further help can be obtained from your service representative.

**When you finish your entries in the Hardware Setup/ Configuration Program**: Press ESC (escape) to exit the Hardware Setup/Configuration Program. The message, Are You Done Making Changes <Y/N>? is displayed on the screen.

If you have more changes to make, type N for no, and you can continue making changes. Otherwise type Y for yes. You are then asked if you want to save these new settings. Press ENTER/RETURN to save these settings, or ESC to cancel all changes.

# Boot Command

Next to the SETUP command, the B, or boot, command is probably the most common command you will use from the Monitor program.

The boot command allows your computer to boot the operating system from a disk drive. The command contains instructions to boot from either a floppy or a hard disk drive.

**Booting from Floppy Disk Drives** — To boot from floppy disk drive A, insert a bootable floppy disk in drive A, type BF (boot from floppy disk drive), and press the ENTER key. The computer then attempts to read the disk in drive A. If you have a second floppy drive, you can boot from it using the command BF1. When you enter BF, the computer always tries to boot from the last floppy which was used as a boot drive. If you want to boot a different drive, you need to specify it.

## The Monitor Program

If you attempt to boot a disk that does not have the operating system installed on it, one of the following messages will appear on the screen:

```
Disk read error
Correct and press any key to reboot.

Non-system disk
Correct and press any key to reboot

Unformatted partition
Correct and press any key to reboot.
```

If this happens, remove the disk from the drive, insert an operating system disk, and press any key. When the Monitor prompt appears (->), re-enter the boot command. If the Monitor prompt does not appear when you press a key, use the CTRL-ALT-INS key combination to enter the Monitor program.

If you attempt to boot from a floppy drive without a disk in it, +++ DISK ERROR: Drive not ready! +++ appears on the screen. If this happens, simply enter the Monitor program again (using the ESC key), insert a bootable disk into the drive, and re-enter the command.

If you enter a boot command for a drive which is not installed in your computer (such as BF3), one of these error messages will appear on the screen: +++ DISK ERROR:  Bad disk controller! +++ or +++ DISK ERROR:  Drive not ready! +++ If this happens, press the ESC and enter the correct command when the Monitor prompt appears on the screen.

**Booting from Hard Disk Drives** — If your computer has a hard disk drive installed, you can boot from it by typing the command BW and then pressing the ENTER key. The W tells the computer it will be reading the operating system from a hard disk drive. If you have not placed the operating system on the hard disk drive, you will see Non-system disk. If the drive is not formatted, you will see the message Unformatted Partition or No Bootable Partitions. If you enter BW, the computer tries to boot from the last partition which was used as a boot partition. This message is normal and means

## The Monitor Program

you have to install an operating system before you can boot from the hard disk drive.

You can also boot from a particular partition, if your hard disk has been divided into multiple partitions. Use this command, with the appropriate drive (0 through 3) and partition number (1 through 4) for your system, as in this example: BW0:2 ENTER.

If you enter a boot command for a non-existent drive or partition, the following error message will appear on the screen +++ DISK ERROR: Bad disk controller! +++. If this happens, re-enter the Monitor program by pressing the ESC key and then enter the correct command.

If you attempt to boot using a drive number that is larger than 3 or a partition number that is larger than 4 or less than 1, the following message appears on the screen ^ Invalid Command!. If this happens, re-enter the command, using a valid drive or partition number.

# Video and Scroll Mode Command

The computer display is created by turning individual dots on the screen (called pixels) on or off. Your computer does this using one of the twelve video modes and three scroll modes contained in the Monitor program. The resolution (sharpness) of the display, the number of characters per line, the number of lines per screen and the colors available are all defined in the Monitor program video modes. Table 3-3 describes the video modes available. You may select any of them using the following Monitor command:

VM<*video mode*> [*scroll mode*] ENTER

Software programs may also specify particular video and/or scroll modes.

## The Monitor Program

**Table 3-3.  Monitor Program Video Modes**

| MODE NUMBER | DISPLAYABLE COLORS | RESOLUTION |
|---|---|---|
| 0 (Color) | 16 | 40 × 25 text |
| 1 (Color) | 16 | 40 × 25 text |
| 2 (Color) | 16 | 80 × 25 text |
| 3 (Color)[1] | 16 | 80 × 25 text |
| 4 (Color)[2] | 4 | 40 × 25 text<br>320 × 200 graphics |
| 5 (Color)[2] | 4 | 40 × 25 text<br>320 × 200 graphics |
| 6 (Color)[3] | 2 | 80 × 25 text<br>640 × 200 graphics |
| 7 (Monochrome)[4] | 4 | 80 × 25 text<br>720 × 350 graphics |
| D (Color)[5] | 16 | 40 × 25 text<br>320 × 200 graphics |
| E (Color)[5] | 16 | 80 × 25 text<br>640 × 200 graphics |
| F (Monochrome)[6] | 4 | 80 × 25 text<br>640 × 350 graphics |
| 10 (Color)[7] | 4 or 16 | 80 × 25 text<br>640 × 350 graphics |

## The Monitor Program

---

### Table 3-3 (continued).    Monitor Program Video Modes

**NOTES:**

1. This is the default mode.

2. 4 colors in 2 pallets of black/cyan/magenta/white, or black/yellow/green/ red, plus 16 background colors.

3. 2 colors are black and white.

4. This mode is only available with a HGC-compatible monochrome monitor. To use the Hercules capability, you must be in Mode 7. You must also use the MODE command from MS-DOS to operate in the Hercules high-resolution graphics mode. The 4 colors are black, normal, blink, and intensity.

5. 16 of 64 colors are available.

6. This mode is only available with a HGC-compatible monochrome monitor. The 4 colors are black, normal, blink, and intensity.

7. With 64K of RAM on video card, 4 of 16 colors are available. With more than 64K of RAM on the video card, 16 of 64 colors are available.

---

Scroll modes determine how information is moved on and off the screen. The following three scroll modes are available:

**S0 (Software Scroll Mode)** — This mode is commonly used by PC-compatible software and works in all video modes.   When material is scrolled, the display moves one line at a time.   This mode is the default scroll mode for your computer.

**S1 (Hardware Jump Scroll Mode)** — This mode is available with video modes M3 through M6. Like scroll mode S0, the display moves one line at a time, but this mode is much faster because it is hardware controlled. This mode is not compatible with all applications packages.

**S2 (Smooth Scroll Mode)** — This mode is available for use with video mode M6 only. When material is scrolled, the display moves a partial line at a time. This mode generates a more readable display and provides a much smoother appearance.

# Color Bar Command

The Monitor ROM also contains a command which causes the screen to fill with color bars. You can use this to adjust the contrast and brightness on your monitor. On color and enhanced color monitors, 16 colors are displayed. On some monochrome monitors, three shades (the normal display color intensified, the normal display color, and black) are displayed. On other monochrome monitors, 16 shades are displayed. To view the color bars, type the letter C and press the ENTER key.

# Test Command

The Monitor program performs a series of self-tests to make sure the computer is ready to function each time you turn it on. If a malfunction is detected, one or more error messages are sent to the display screen to alert you of the problem. More extensive diagnostic tests are also contained in the Monitor program and may be accessed by typing the Monitor command TEST and then pressing the ENTER key. This test menu appears:

## The Monitor Program

```
CHOOSE ONE OF THE FOLLOWING:

1. DISK READ TEST
2. KEYBOARD TEST
3. BASE MEMORY TEST
4. EXTENDED MEMORY TEST
5. POWER-UP TEST
6. EXIT

ENTER YOUR CHOICE:
```

To run a test, press the number which precedes the test name on the menu. The test you select then begins and continues running until a malfunction is discovered or you stop the test by pressing the ESC key.

Press the ESC key a second time to return to the test menu. From the menu, you may select another test or return to the Monitor prompt by selecting EXIT. Chapter 6 contains more detailed information about each of the tests contained in the Monitor program.

# Machine Language Debugging Commands

The Monitor program also contains a complete set of machine language debugging commands. These commands allow experienced programmers to test procedures and routines, examine memory and register contents, and troubleshoot and remove mistakes from programs. Table 3-4 lists the commands available, and provides a brief description of each.

These commands should be used only if you are familiar with programming and microprocessor architecture. If you want to know more about the debugging commands and how to use them, contact your service representative for information about the technical reference manual for your computer.

**Table 3-4.   Machine Language Debugging Commands**

| COMMAND | SYNTAX | DESCRIPTION |
|---|---|---|
| Display memory | D*<address>* | Displays contents of 128 bytes of memory beginning at specified address. |
| | D*<address>* L*<bytes>* | Displays contents of specified number of bytes of memory beginning at specified address. |
| Display memory | D*<range>* | Displays contents of specified block of memory. |
| Examine memory | E*<address>* | Displays and allows user to alter contents of specified memory location. |
| Fill memory | F*<range>*,*<data byte>* | Enters specified data byte into each memory location in specified memory block. |
| | F*<range>*,"ASCII string" | Enters specified ASCII string into specified memory block. |
| Execute (Go) | G=*<address>* | Begins execution of program at specified address. |
| | G=*<address>*,*<breakpoint>* | Begins execution of program at specified address and halts at breakpoint. |
| Hex math | H*<number1>*,*<number2>* | Displays the sum and the difference of the specified hexadecimal numbers. |
| Input from port | I*<port address>* | Displays contents of specified port. |

## The Monitor Program

### Table 3-4 (continued).    Machine Language Debugging Commands

| COMMAND | SYNTAX | DESCRIPTION |
|---|---|---|
| Move memory block | M*\<range>*,*\<destination>* | Copies contents of specified memory block to another specified memory block. |
| Output to port | O*\<port address>*,*\<data>* | Writes specified data to specified port address. |
| Examine registers | R*\<register name>* | Displays contents of specified CPU register and allows modification of contents. |
| Search memory | S*\<address>*L*\<bytes>*,*\<data>* | Searches specified memory block for specified data byte and displays address data found. |
|  | S*\<range>*L*\<bytes>*,"ASCII" | Searches specified memory block for specified ASCII character and displays address character found. |
| Trace program | T*\<count>* | Executes specified number of lines of an assembled program in single-step mode. |
| Unassemble program | U*\<range>* | Displays mnemonics and hex coding for specified memory block. |

# Chapter 4
# Understanding Your Computer Hardware

This chapter helps you to know what the components of your computer are and what they do.

The basic components, or what is commonly referred to as hardware, are shown in Figure 4-1.
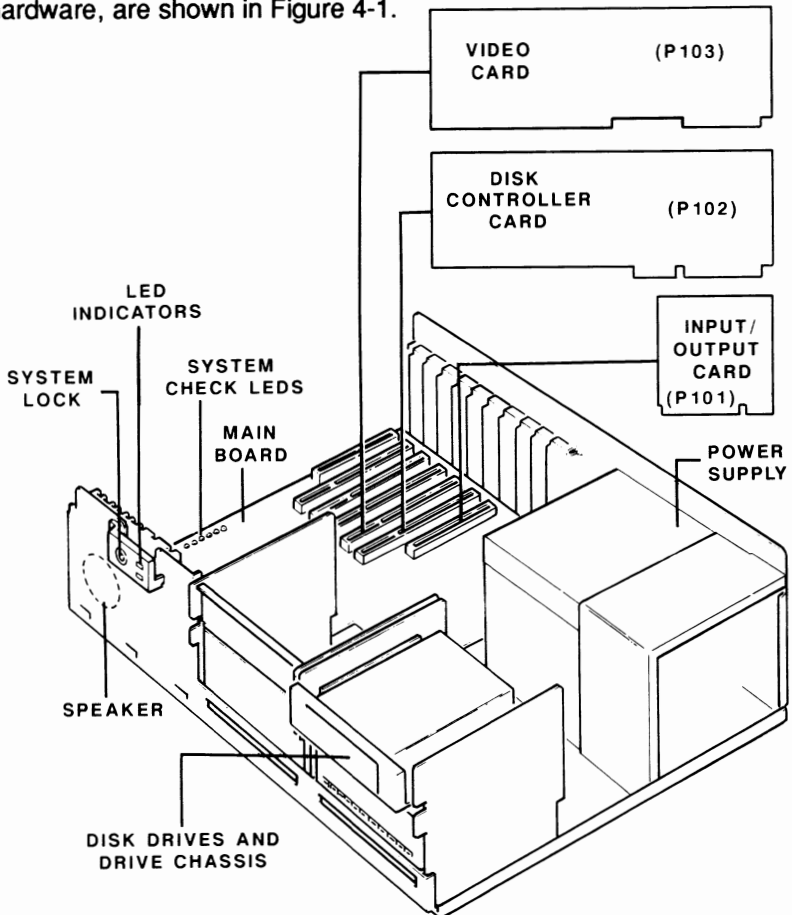


Figure 4-1.  Your Computer Hardware

## Understanding Your Computer Hardware

# Indicators, Speaker, and System Lock

Refer to Figure 4-2 for the locations of the following:

**Power Indicator** — Indicates when power to the computer is on.

**Hard Disk Indicator** — Lights when the hard disk is in use.

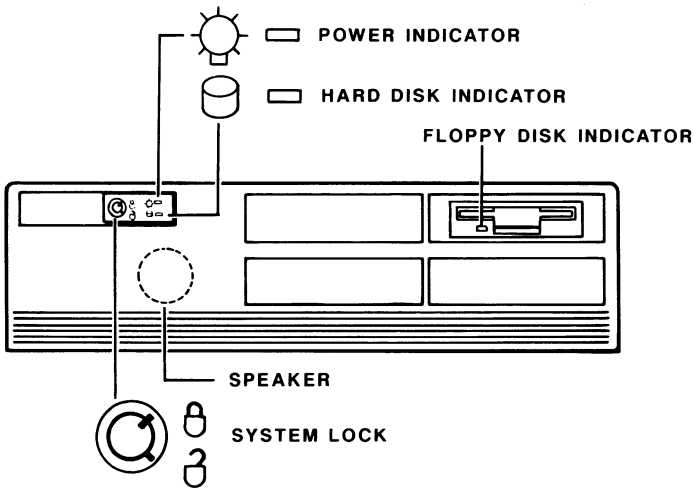**Floppy Disk Indicator** — Lights when the floppy disk drive is in use.

**Figure 4-2.   Front View of the Computer**

## Understanding Your Computer Hardware

**System Lock** — Locks the system cover and keyboard. When it is locked, the computer can operate, but there can be no input from the keyboard and the cover cannot be removed. The symbol indicates the locked and unlocked positions. You can remove the key in either position.

Store the spare key in a safe place and record the key number in case you need to order additional keys. If you need to replace a key, take the extra key or the key number to a locksmith. (Extra keys are not available from Zenith Data Systems.)

This system lock can be very useful. For example, if you are running a lengthy program and need to leave the computer unattended, you can lock the computer and no one can use your files or interrupt your program. The system lock is also beneficial in a networking situation. The computer can act as a network file server if you set it to automatically boot from the hard disk (using the Hardware Setup/Configuration Program).

**Speaker** — An 8-ohm, 2-inch speaker is mounted inside on the front panel of the computer. The speaker provides audible feedback in case of errors. Many games incorporate sounds. There are also software programs that support various tones and durations so you can program your computer to play a limited range of music.

## Understanding Your Computer Hardware

# Switches and Connectors

All connections between the computer and any other equipment or peripherals are made at the back of the computer.

The voltage-select and power switches are also on the back panel.

**Voltage Select Switch** — The voltage-select switch is set for 115 VAC operation by the manufacturer. The computer power cord is polarized, grounded, and shielded and is intended for standard 115 VAC operation. If you are using a 220-230 VAC source, the voltage-select switch must be changed and the power cord replaced with one designed for 220-230 VAC operation. (Contact your authorized service center.)
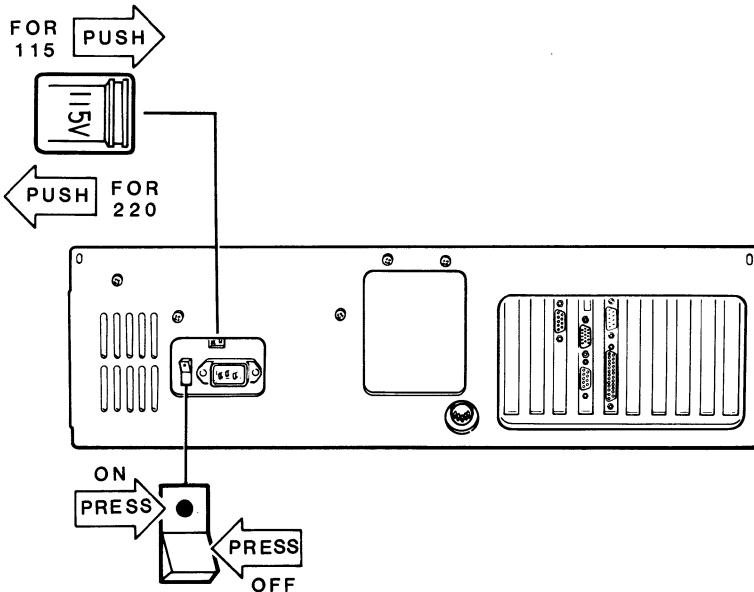
Figure 4-3.    Voltage Select and Power Switch

## Understanding Your Computer Hardware

**Power Switch** — To turn the computer on, press the switch at the top. To turn the computer off, press the switch at the bottom. (A switched power strip may also be used to turn the computer on or off. Refer to Chapter 1 for details.)

Figure 4-4 shows the connectors for the keyboard and the circuit cards in your computer. The pinout tables for these connectors are included in the description of the various cards which follows later in this chapter.
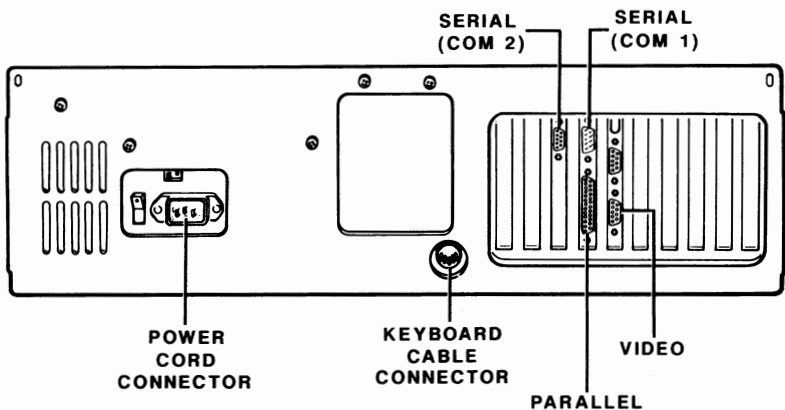


**Figure 4-4. Connectors**

## Understanding Your Computer Hardware

# Power Supply

### WARNING

Do not remove the power supply cover under any cir-
cumstances. There are no servicable components inside
the power supply. With the cover off, serious shock
hazards are present inside the power supply housing.

The power supply converts the 115 volts (or 230 volts) from a power
outlet to the +5 VDC, -5 VDC, +12 VDC, and -12 VDC that power
the computer. With 200 watts of power, the power supply can
support up to two hard disk drives, two floppy disk drives, and
additional circuit cards.

Two LEDs on the input/output card light to confirm the proper
operation of the +12 VDC and -12 VDC. A DCOK (DC okay) green
LED on the main circuit board indicates when all voltages are at the
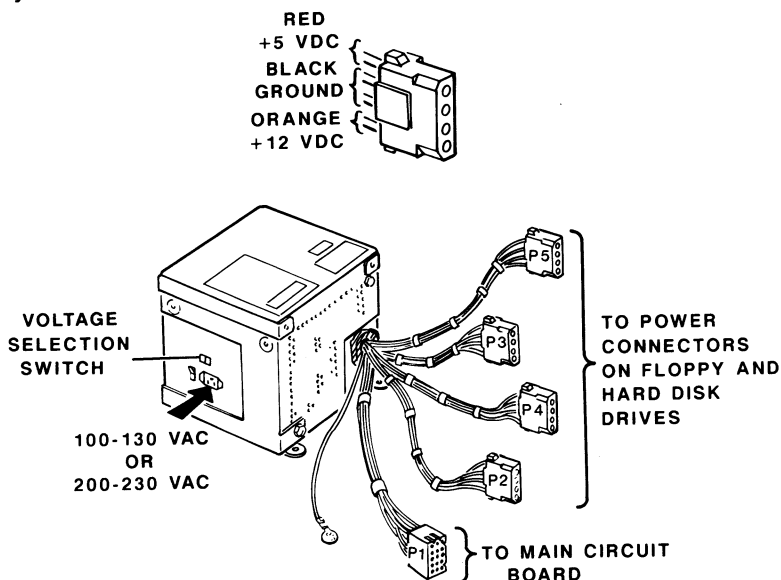proper level. A green LED on the front panel indicates +5 VDC is
okay.

Figure 4-5.    Power Supply

## Understanding Your Computer Hardware

The power supply has four 4-pin connectors that supply power to the disk drives. The connectors are not dedicated to any particular drive. However, two of the cables are shorter than the other two. So, the distance between the drive connector and the cable connector is the only determining factor.

The 15-pin connector on the power supply plugs into the main circuit board and supplies power to the circuit cards, keyboard, and speaker. The ground wire uses the chassis as ground.

# Disk Drives, Disk Chassis, and Cables

The disk drives in your computer transfer data between computer memory and floppy or hard disks. Your computer has a 1.4-megabyte, 3.5-inch, half-height, double-sided, high-density, 135 tpi floppy disk drive. It is installed in the top position in the outer drive chassis and is usually referred to as drive A.

You also have a high-capacity hard disk drive in the lower position in the outer drive chassis. This drive is usually referred to as drive C.

The inner drive chassis can be used to install a second floppy disk drive, either 3.5-inch or 5.25-inch, and a second hard disk drive.
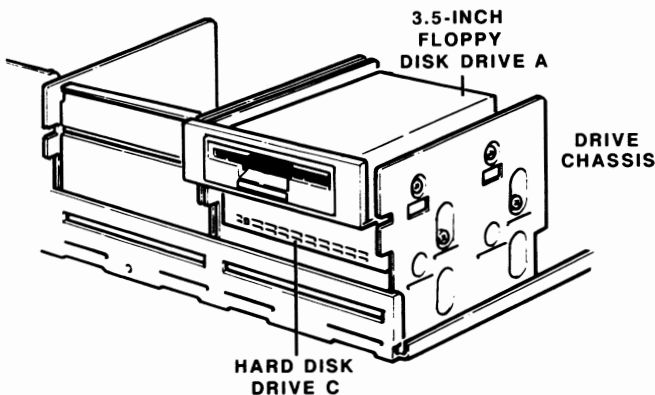


**Figure 4-6. Disk Drives and Chassis**

## Understanding Your Computer Hardware

With the floppy disk cable, shown in Figure 4-7, you can connect two 3.5-inch drives or a 3.5-inch drive and a 5.25-inch drive.
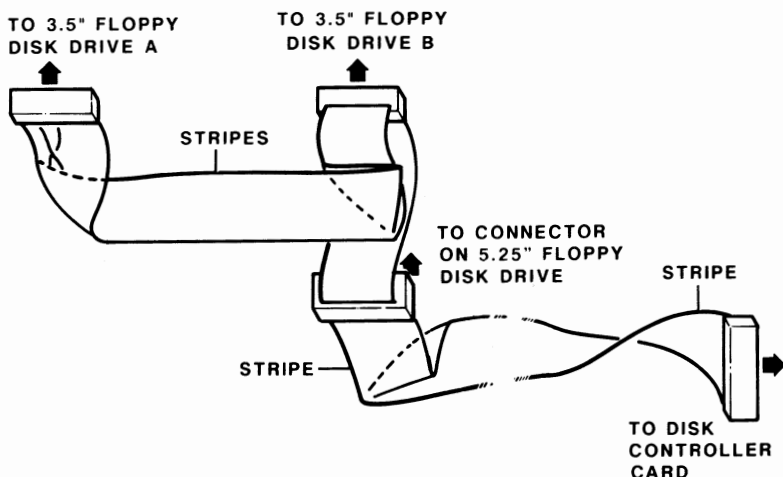
TO 3.5" FLOPPY
DISK DRIVE A

TO 3.5" FLOPPY
DISK DRIVE B

STRIPES

TO CONNECTOR
ON 5.25" FLOPPY
DISK DRIVE

STRIPE

STRIPE

TO DISK
CONTROLLER
CARD

**Figure 4-7.    Floppy Disk Cable**

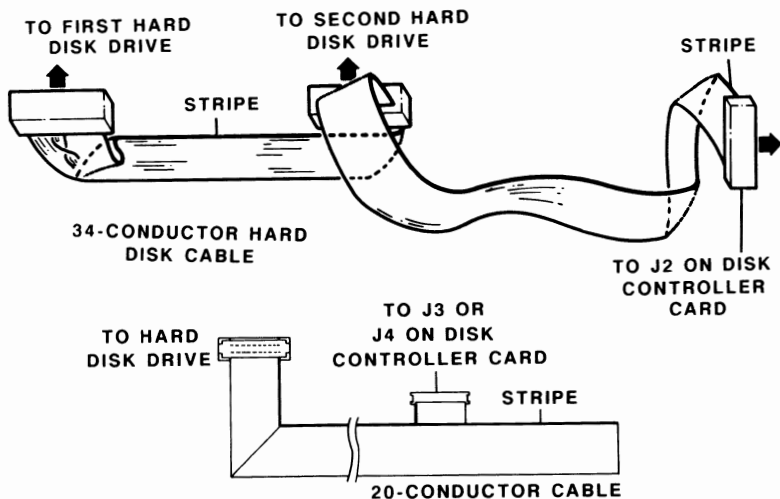The hard disk cables are shown in Figure 4-8. They connect between the hard disk drive and the disk controller card.

TO FIRST HARD
DISK DRIVE

TO SECOND HARD
DISK DRIVE

STRIPE

STRIPE

34-CONDUCTOR HARD
DISK CABLE

TO J2 ON DISK
CONTROLLER
CARD

TO HARD
DISK DRIVE

TO J3 OR
J4 ON DISK
CONTROLLER CARD

STRIPE

20-CONDUCTOR CABLE

**Figure 4-8.    Hard Disk Cables**

# Main Circuit Board

The main circuit board has several functions:

*   It contains the most important part of the computer, the CPU (central processing unit) and its related logic.

*   It also serves as a backplane that ties the entire computer together.

*   A standard 1 M of RAM (random access memory) that is expandable to 6 M is also on the main circuit board.

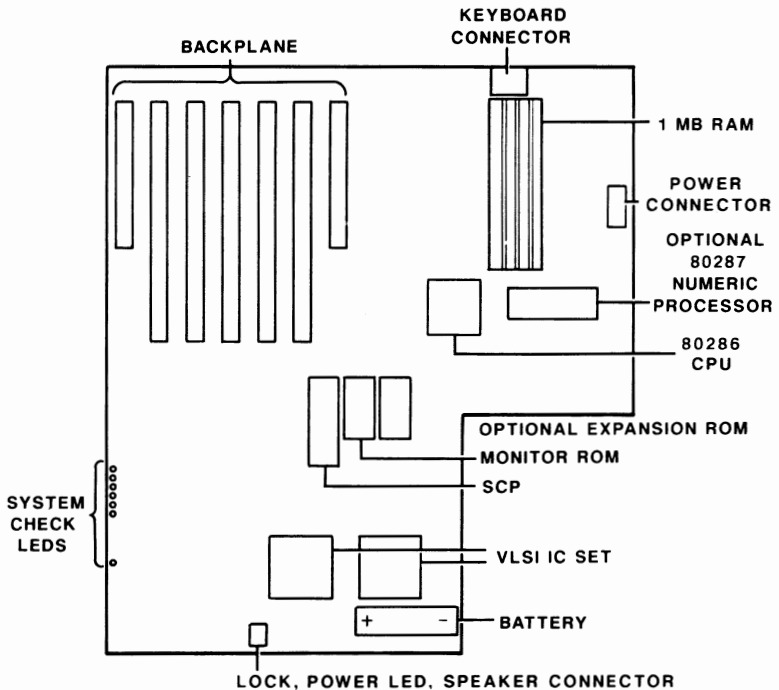Figure 4-9 shows the locations of the main components on the main circuit board.



**Figure 4-9.   Main Circuit Board**

Understanding Your Computer Hardware

## Central Processing Unit (CPU)

The CPU function on the main board processes information, performs arithmetic functions, and controls the rest of the computer system. It is comprised of several ICs (integrated circuits) which include the 80286 microprocessor, an optional 80287 numeric processor, the Monitor ROM, and 1 M of RAM.

**Microprocessor** — The 16-bit 80286 IC consists of four sections:

• An instruction unit that decodes instructions and holds them until they can be executed by the microprocessor.

• An execution unit that sequentially carries out the instructions.

• An address unit that computes the addresses that are sent out to memory or input/output devices.

• A bus unit that performs all memory and input/output read and write operations and gathers instructions for the instruction unit to decode.

**Numeric Processor** — The main circuit board also has a socket for an optional 80287 numeric processor. The processor speeds up certain types of calculations that some applications require by assuming some of the arithmetic processing from the microprocessor. Only numeric programs designed to use the numeric processor, or that check to see if one is installed, benefit from it. (Instructions for installing the processor are in Chapter 5.)

**Monitor Read-Only Memory (ROM)** — This IC stores the Monitor program and routines that the computer needs to operate. Since this program may be used, but not changed, it is known as firmware. (The Monitor program is described in Chapter 3.) There is also a socket for an expansion ROM for custom operations.

## Understanding Your Computer Hardware

**Random Access Memory (RAM)** — This memory is both a temporary storage area and a work area for the information and programs your computer handles. This memory is where your computer stores data while it is working on an application. The larger the RAM space, the more information that can be handled.

Memory is measured in bytes. Each byte represents approximately one character or keystroke. The microprocessor can handle up to one gigabyte of memory.

Your computer comes with 1M of 12 MHz, 0 wait-state memory which can be expanded to 6M by adding SIMMs (single in-line memory modules) to the main circuit board. Four 256K RAM SIMMs make up the base memory. (Chapter 5 includes instructions for upgrading memory.) Additional RAM cards can be installed in the expansion slots for a potential of 16M of system RAM. (This memory will run at 8 MHz.)

**VLSI IC Set** — These ICs are a low power, highly integrated design that replaces many ICs that were responsible for major logic functions of the PC-AT architecture.

**Backplane** — The main circuit board also provides the physical connection for address, data, and control signals between the cards. It has seven connector slots for circuit cards. Card slots P101 and P107 are PC-compatible, 8-bit. Card slots P102 through P106 are PC/AT-compatible, 16-bit card slots.
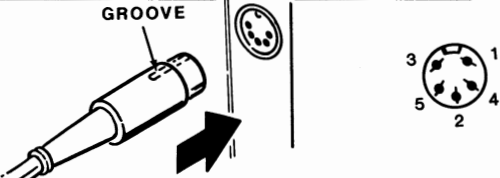
**Battery** — The 3.6-volt lithium battery that powers the clock/calendar when the computer is off is on the main circuit board. This allows time/date information to be retained even if the other circuit cards are removed. This battery also powers some computer memory. (Chapter 6 describes how to change the battery.)

## Understanding Your Computer Hardware

**Keyboard Connector** — The cable from the keyboard plugs into the 5-pin connector on the main circuit board. The pinout for the connector is shown in Table 4-1.

**Table 4-1.   Keyboard Connector**

| PIN NO. | SIGNAL |
|---------|--------|
| 1 | Clock |
| 2 | Data |
| 3 | No connection |
| 4 | Ground |
| 5 | +5 volts |

**Power Supply Connector** — The 15-pin power supply connector connects to the main circuit board to supply power for the main board and the cards connected to it.

**Lock/Speaker/Power Connector** — The 5-pin plug from the front panel system lock connects to the main circuit board. Table 4-2 lists the pinout for this connector.

**Table 4-2.   Lock/Speaker/Power Connector**

| PIN | SIGNAL |
|-----|--------|
| 1 | Panel LED power |
| 2 | Audio out |
| 3 | +5 VDC |
| 4 | Panel lock switch |
| 5 | Ground |

# Understanding Your Computer Hardware

Figure 4-10 shows the jumpers as they are set by the manufacturer. Leave the jumpers as shown unless you install 6 megabytes of memory on the main board. Then move the jumper at J102 from pins 2 and 3 to pins 1 and 2.
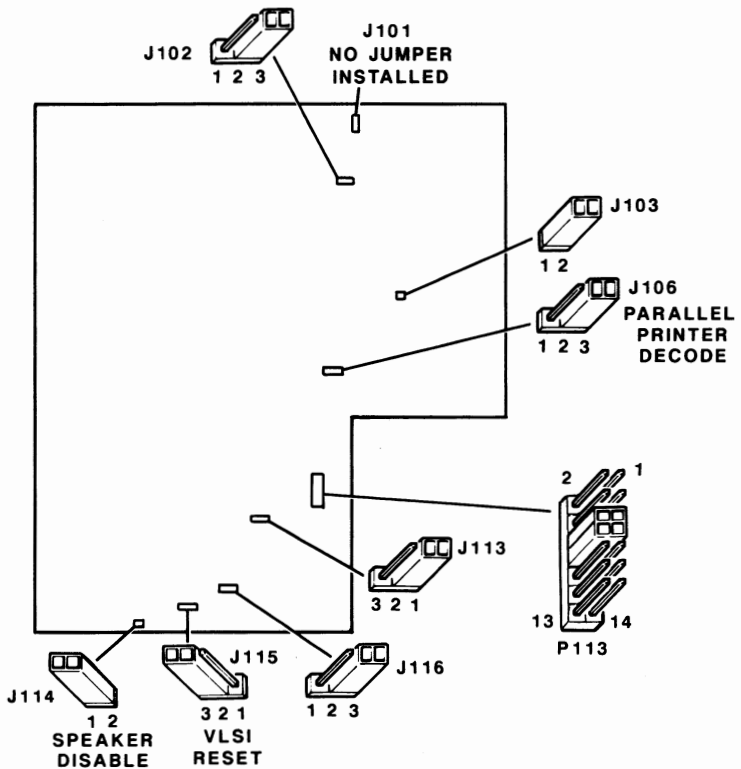


**Figure 4-10.  Main Circuit Board Jumper Settings**

# Input/Output Card

The input/output (I/O) card is installed at P101. It has a parallel and serial connector which is accessible at the fourth connector opening on the back panel. A ribbon cable with a second serial connector plugs into the I/O card at P201. This serial connector is accessible at the third connector opening on the back panel. These connectors are for peripherals, such as printers, plotters, modems, graphics tablets, or a mouse.

**Parallel Connector** — The parallel connector is the 25-pin connector on the I/O card. It is designed to be used with Centronics-type peripherals with a DB-25 connector, such as a parallel printer. Table 4-3 lists the pinout for this connector.

The MS-DOS operating system automatically configures the port as a standard printer port. This means that all you need to do if you are using a parallel printer is to connect to the parallel connector. If you are using another operating system, refer to that documentation for proper configuration.

**Table 4-3.    Parallel Connector (LPT1)**

| PIN NO. | SIGNAL | PIN NO. | SIGNAL |
|---------|--------|---------|--------|
| 1 | Strobe | 10 | Acknowledge |
| 2 | Data bit 0 | 11 | Busy |
| 3 | Data bit 1 | 12 | Page end |
| 4 | Data bit 2 | 13 | Select |
| 5 | Data bit 3 | 14 | Auto feed |
| 6 | Data bit 4 | 15 | Error |
| 7 | Data bit 5 | 16 | Initialize printer |
| 8 | Data bit 6 | 17 | Select input |
| 9 | Data bit 7 | 18-25 | Ground |
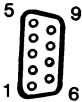
## Understanding Your Computer Hardware

**Serial Connector** — The serial connectors are 9-pin D-type connectors used for RS-232C serial devices. Before you connect a serial device, make sure the computer and the serial device are "speaking the same language." This is accomplished by configuring the communications protocol.

The communications protocol is the set of rules that controls the exchange of information between the computer and the serial device. No one protocol is best, but your computer and the device must use the same protocol. Your operating system manual and the documentation for the serial device has this information.

These serial ports are enabled/disabled from the keyboard using the Monitor Hardware Setup/Configuration Program.

Table 4-4 identifies the pin number and corresponding signal for the serial connectors.

**Table 4-4. Serial Connectors (COM1 and COM2)**

| PIN NO. | SIGNAL | PIN NO. | SIGNAL | |
|---------|--------|---------|--------|---|
| 1 | Carrier detect | 6 | Data set ready | |
| 2 | Receive data | 7 | Request to send | |
| 3 | Transmit data | 8 | Clear to send | |
| 4 | Data terminal ready | 9 | Ring indicate | |
| 5 | Ground | | | |
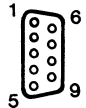
## Understanding Your Computer Hardware

Figure 4-11 shows the main components on the I/O card. Two LEDs light to show that the +12V and −12V supplies are present. The jumpers are shown as they are set by the manufacturer. Leave the jumpers in these positions when this card is the only I/O card and is being used as dual serial/printer ports.
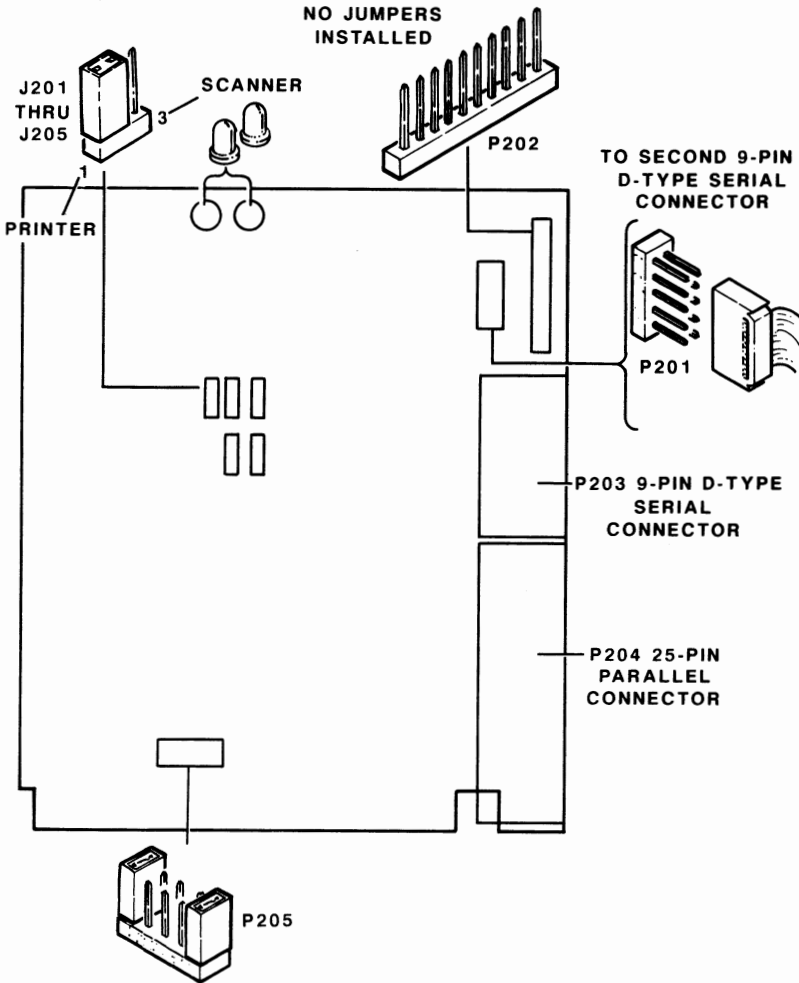


**Figure 4-11.    I/O Card Components and Jumper Settings**

# Disk Controller Card

The disk controller card directs the transfer of data to and from the drives. It is mounted in the second card slot on the main circuit board, P102. The disk controller card supports up to two floppy disk drives and two high-capacity hard disk drives. All cables from the drives are connected to the disk controller card with the striped edge at the top, as shown in Figure 4-12.
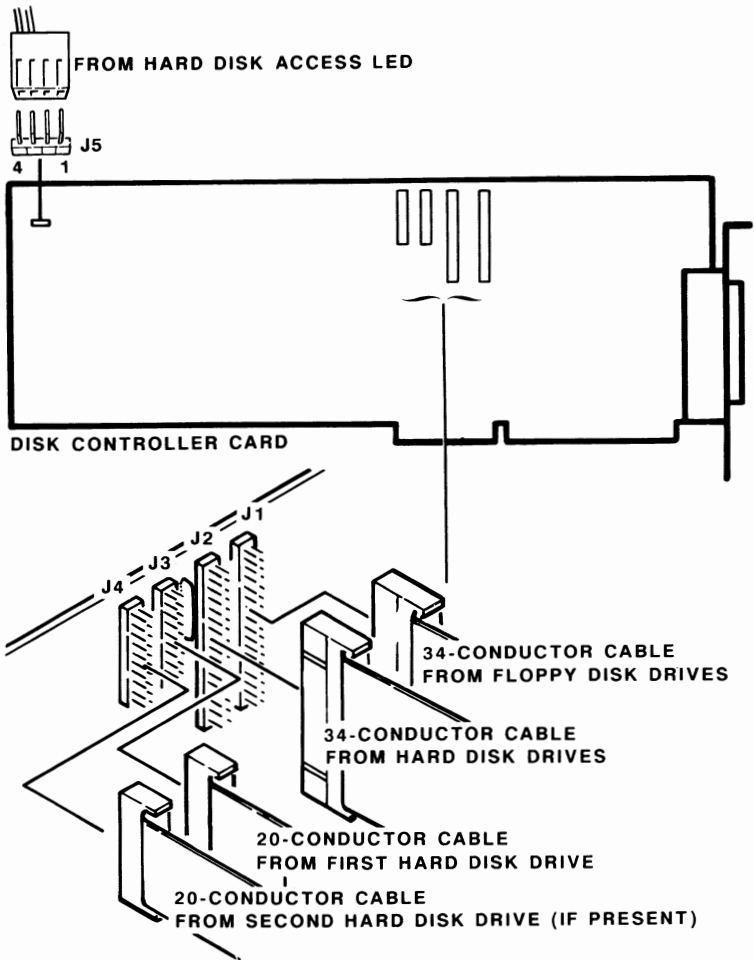


**Figure 4-12. Disk Controller Card Cable Connections**

## Understanding Your Computer Hardware

The 4-pin plug from the front panel system lock connects at J5. The pinout of this connector is shown in Table 4-5.

**Table 4-5.   Hard Disk Access LED (J5)**

| PIN No. | SIGNAL |
|---------|--------|
| 1 | +5 VDC |
| 2 | Ground |
| 3 | Ground |
| 4 | +5 VDC |
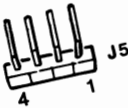
A jumper is installed at W5. At W6 jumpers are on pins 2, 3, 5, and 6. There are no jumpers at W2 and W3. (Refer to Figure 4-13.)
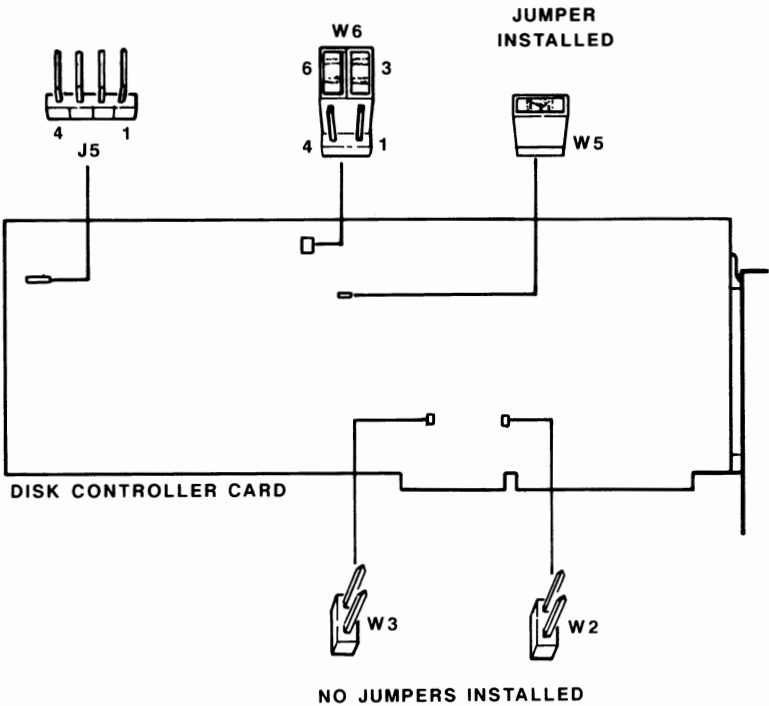


**Figure 4-13.   Disk Controller Card Jumpers**

# Video Card

Two video output connectors are available on the video card, which is installed at P103 on the main circuit board backplane. These two connectors let you connect almost any type of video monitor. However, the video card must be configured for the monitor you are using. Two jumpers and a 6-section DIP (dual in-line package) switch are used to configure the video card. Figure 4-14 shows the location of the jumpers and DIP switch.

**CAUTION**

As shipped from the manufacturer, the video circuit card is set for either a 31.49 kHz analog RGB video monitor or a multi-sync monitor. To prevent damage to the video card, monitor, or both, be certain that the video card is properly configured for the monitor you are using.
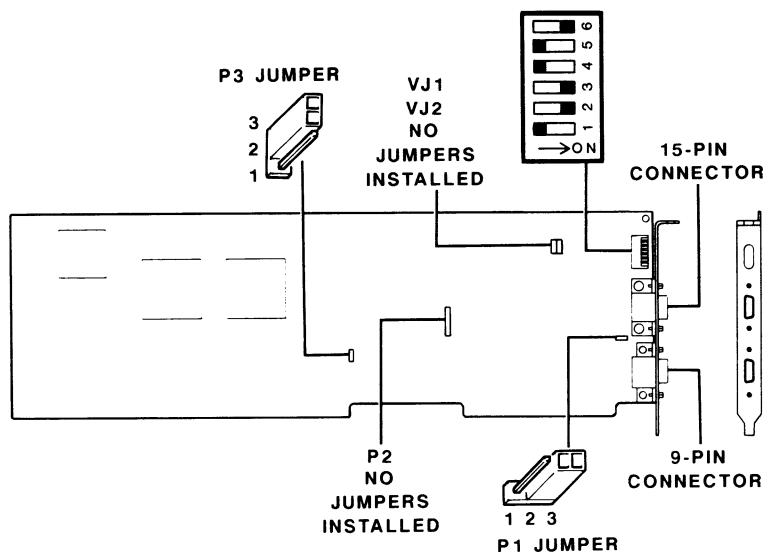


**Figure 4-14. Video Card Jumper and Switch Locations**

## Understanding Your Computer Hardware

The video card can produce CGA (color graphics adapter), EGA (enhanced graphics adapter), MDA (monochrome display adapter), and Hercules video signals in their standard (TTL) form. These standard signals are available at the 9-pin D-type connector. Use this connector with standard EGA (RGBrgb), CGA (RGBI or RGB), MDA (TTL monochrome), and Hercules (TTL monochrome) monitors. Refer to Table 4-8 (which follows later in this section) for examples of these monitors and the corresponding configuration. Refer to Table 4-6 for the pinout for the 9-pin connector.

**Table 4-6.  9-Pin Video Card Connector**

| PIN | MONOCHROME | COLOR | ENHANCED COLOR |
|-----|------------|-------|----------------|
| 1 | Ground | Ground | Ground |
| 2 | Ground | Ground | Secondary red |
| 3 | Red | Red | Red |
| 4 | Green | Green | Green |
| 5 | Blue | Blue | Blue |
| 6 | Intensity | Intensity | Secondary green |
| 7 | Video | — | Secondary blue |
| 8 | Horizontal sync | Horizontal sync | Horizontal sync |
| 9 | Vertical sync | Vertical sync | Vertical sync |
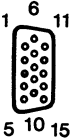
## Understanding Your Computer Hardware

The video card can also produce an analog RGB video signal at a constant 31.49 kHz horizontal scan frequency. CGA, EGA, MDA, Hercules, and Zenith 480-line (VGA-type) displays can all be produced using a 31.49 kHz analog RGB video monitor. These analog RGB video signals are available at the 15-pin D-type connector. Refer to Table 4-8 (which follows later in this section) for examples of these monitors and the corresponding configuration. Table 4-7 lists the pinout for the 15-pin connector.

**Table 4-7.  15-Pin Video Card Connector**

| PIN | SIGNAL | PIN | SIGNAL |
|-----|--------|-----|--------|
| 1 | Red video | 9 | N/C |
| 2 | Green video | 10 | Digital/sync ground |
| 3 | Blue video | 11 | Reserved (mode) |
| 4 | N/C | 12 | Reserved |
| 5 | Reserved (test) | 13 | Horizontal sync |
| 6 | Red video ground | 14 | Vertical sync |
| 7 | Green video ground | 15 | Vertical sync |
| 8 | Blue video ground | | |

## Understanding Your Computer Hardware

The DIP switch (SW1) on the video card is accessible through the back panel. Figure 4-15 shows some typical types of DIP switches. Use a ballpoint pen or similar object to change the settings on the DIP switch. Do not use a pencil, since the lead can break.



ROCKER          LEVEL          SLIDE
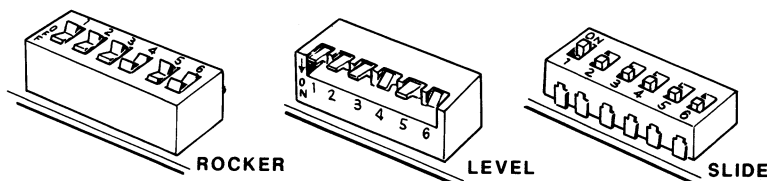
**Figure 4-15.   Typical DIP Switches**

DIP switch sections 1 through 4 define the type of video display to be produced: CGA, EGA, MDA, Hercules, or Zenith 480-line (VGA type).
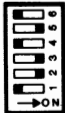
DIP switch section 5 activates the automode feature. Automode automatically switches the display output of the video card between CGA and EGA or between MDA and Hercules under software control. As shipped from the manufacturer, this section is ON and is set to change modes as your software requires. When this section is OFF, the feature is disabled.

DIP switch section 6 selects between 31.49 kHz analog RGB signals (available at the 15-pin connector) and standard (TTL) signals (available at the 9-pin connector). This switch section must be in the ON position if you are operating a 31.49 kHz analog RGB color video monitor. If you are connecting a standard EGA, CGA, MDA, or Hercules-compatible monitor to your computer, switch section 6 should be in the OFF position.

Table 4-8 lists examples of monitors and the corresponding video card configuration.

## Table 4-8. Typical Video Hardware Configuration

| MONITOR | DISPLAY | CONNECTOR | SWITCH | JUMPERS P1 | P3 |
|---------|---------|-----------|--------|------------|-----|
| ZVM-1330 or other CGA monitor | CGA (15.70 kHz) (Color Graphics Adapter) | 9-pin | OFF ON ON OFF OFF OFF →ON | | |
| ZVM-1380-C or other EGA monitor | EGA (Enhanced Video RGBI RGBrgb) | 9-pin | OFF ON OFF ON ON OFF →ON | | |
| ZMM-1470-G or other EGA monitor | EGA (Enhanced Video RGBI RGBrgb) | 9-pin | OFF ON OFF ON ON OFF →ON | | |
| ZVM-1240 or other MDA monitor | MDA (TTL monochrome display) | 9-pin | OFF ON OFF ON OFF OFF →ON | | |
| ZCM-1390* or other VGA monitor | VGA (Video Graphics Array) | 15-pin | ON ON OFF ON ON OFF →ON | | |
| ZCM-1490* or other VGA monitor | VGA (Video Graphics Array) | 15-pin | ON ON OFF ON ON OFF →ON | | |
| ZMM-149 or other VGA monochrome monitor | VGA (Video Graphics Array monochrome) | 15-pin | ON ON OFF OFF ON ON →ON | | |

*Setting as shipped from the manufacturer.

**NOTE**: Some monochrome monitors operate with color signals rather than monochrome signals. Check your monitor documentation. If the monitor uses RGB signals, set the DIP switch for the appropriate color or enhanced color mode.

Understanding Your Computer Hardware

# Specifications

| | |
|---|---|
| Processor: | 80286 16-bit. |
| Numeric processor (optional): | 80287 or 80C287 numeric data. |
| Clock rate: | 12 MHz, 0 wait states. System DRAM (8 MHz, 1 wait state to the bus; IBM-AT compatible.) |
| Monitor ROM: | MFM-200 Monitor containing boot code and menu-selectable tests. |
| Card connectors: | Seven total: five PC/AT (three available for expansion) and two PC (one available for expansion). |
| Memory: | 640K system with 256K EMS and slushware. 1 megabyte standard, expandable to 3 or 6 megabytes on main board. |
| Video: | High-resolution analog standard; color graphics and color text modes suitable for high-resolution analog, multi-sync, and standard EGA, CGA, and TTL-compatible monochrome video monitors.

Automatic detection in some configurations and emulation of EGA, CGA, MDA, and HGC modes. |
| Refresh rates: | 50 Hz or 60 Hz, menu-selectable. |

## Understanding Your Computer Hardware

Text mode (alphanumeric): 40 or 80 characters per line, 25 lines per screen.

Graphics mode
(all points addressable): 640 x 400 high-resolution analog,
640 x 350 enhanced color,
320 x 200 and 640 x 200 color,
720 x 350 monochrome text,
640 x 350 monochrome graphics.

Available colors: Sixteen colors selectable from a palette of 256,000 for high-resolution analog applications.
Sixteen colors selectable from a pallette of 64 for EGA applications.

Video output: Analog RGB output via a 15-pin subminiature D-type connector.

RGBrgb, RGBI, or TTL-compatible monochrome via 9-pin D-type connector.

Video memory: 256 kilobytes of video RAM.

Horizontal scan
frequencies: 31.49 kHz analog,
15.75 kHz CGA,
18.4 kHz MDA and HGC,
21.85 kHz EGA.

# Understanding Your Computer Hardware

Input/Output Ports
  Serial ports:                  Two asynchronous serial RS-232C ports (AT-style DB-9 connector). One start bit; 7- or 8-bit word length; one or two stop bits; selectable baud rates of 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud; RD, CTS, DSR, CD signals recognized; TD, RTS, DTR control signals generated; half- of full-duplex operation; enabled by Setup/Configuration program.

  Parallel port:               Centronics-type parallel output port (DB-25 connector).

  Disk controller:           Dual hard disk and dual floppy.

  Disk drives:               One 3.5-inch floppy disk drive, One 40 or 80 megabyte half-height hard disk drive. Expandable to two floppy disk drives, 5.25-inch or 3.5-inch, and two hard disk drives.

  Keyboard:                 101-key; 5-pin DIN connector on main circuit board accessible from back panel.

Power supply
  Type:                      Switch-selectable, 200 watts.
  Input:                    100-130 VAC @ 60 Hz; 200-230 VAC @ 50 Hz.
  Output:                 +5 VDC, -5 VDC, +12 VDC, -12 VDC.
  Status LEDs:            DC OK on main circuit board, +12V and -12V on I/O card.

## Understanding Your Computer Hardware

Battery backup:                3.6V lithium battery on main circuit
                               board for real-time clock and
                               configuration data.

Audio:                         8-ohm, 2-inch speaker on inside of
                               front panel.

Size
   Computer:                   21 x 17 x 6.0 inches
                               (53 x 43 x 15 cm).

   Keyboard:                   18.5 x 8 x 1.5 inches
                               (47 x 20 x 9 cm).

Weight:                        Approximately 54 lbs (24.3 kg) in
                               carton w/keyboard and manual.


Zenith Data Systems reserves the right to discontinue
products and to change specifications at any time without
incurring any obligation to incorporate new features in
products previously sold.

# Chapter 5
# Adding to Your Computer

This chapter describes how to add options to your computer, such as:

•   Additional circuits cards.

•   An 80287 numeric data processor to speed up the   processing and calculating of numeric data used by some software programs.

•   Memory modules for increased memory capacity.

•   A 3.5-inch or 5.25-inch floppy disk drive.

•   A high-capacity hard disk drive.

The only tools you need to install the above options are a standard #2 phillips head screwdriver and a flat-blade screwdriver.

Follow the instructions on the next page to remove the cover of your computer prior to installing an option.

Adding to Your Computer

# Removing the Cover

**WARNING**

Hazardous voltages are present inside the computer when it is connected to an AC power source. Always disconnect the computer from the AC power source before you remove the cover.

To remove the cover of your computer:

1.  Turn off the power switches on your computer and all other peripherals. Disconnect them from their AC power source. Then disconnect the keyboard, video monitor, and any other peripherals from your computer.

2.  Refer to Figure 5-1 and remove the six screws and set them aside.
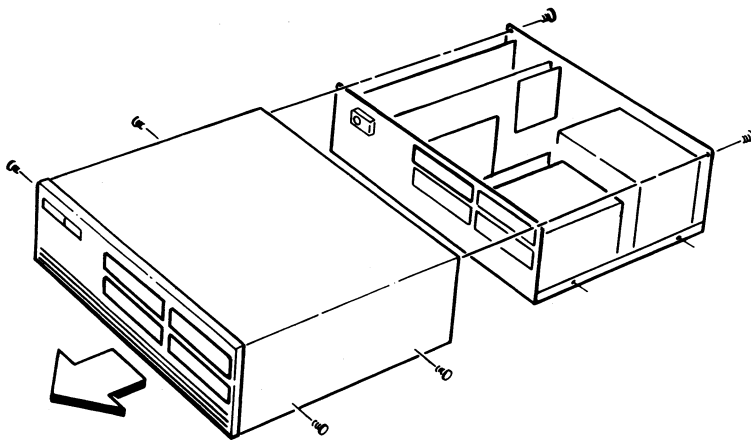


**Figure 5-1.    Removing the Cover**

3.  Slide the cover of the computer toward the front while holding it up so you do not catch any wires, cables, or connectors.

When you replace the cover of your computer, reverse the above procedure. Be certain all cards are securely installed and all cables are routed so they will not catch when you replace the cover.

# Installing Circuit Cards

### CAUTION

To prevent damage from static electricity, keep all circuit cards in their protective packaging until you install them in the computer.

To install a circuit card in your computer:

1.  Remove the cover following the procedure on the previous page.

2.  Circuit cards with descenders can be installed in card slot P105 or P106. Figure 5-2 shows the location of the cards in your computer. Choose a 16-bit PC/AT-compatible card slot, P104 through P106, for your card or a PC-compatible card slot, P107.
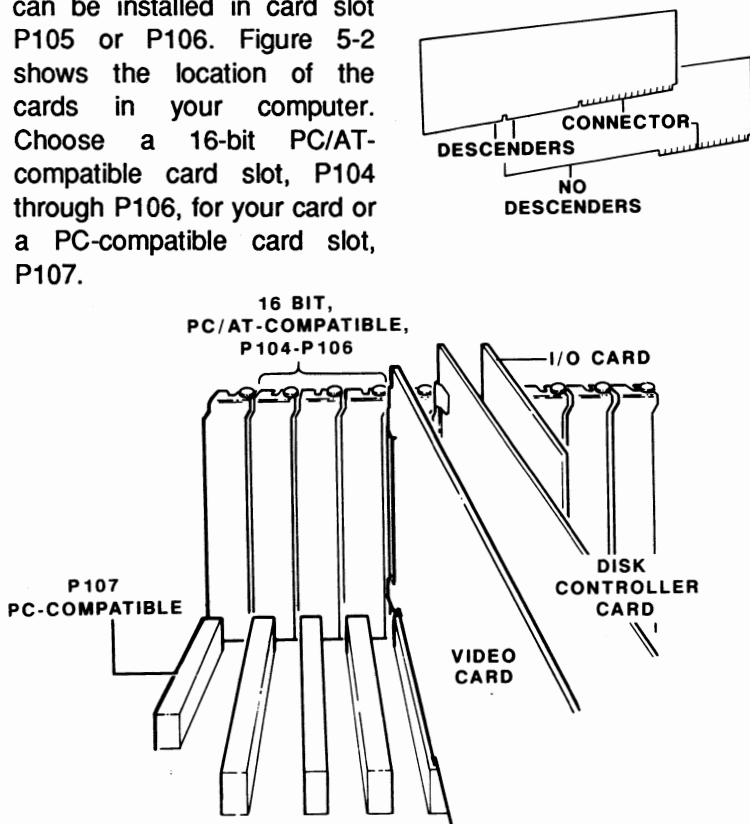




**Figure 5-2.    Installed Cards and Expansion Slots**

## Adding to Your Computer

CARD SUPPORT
BRACKET SCREW

ALIGN AND LOWER
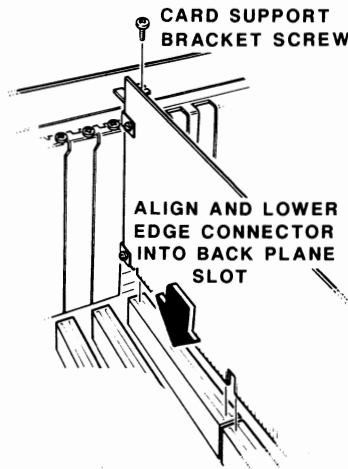EDGE CONNECTOR
INTO BACK PLANE
SLOT

**Figure 5-3.    Installing a Circuit Card**

3.    Refer to Figure 5-3 and remove the screw that secures the bracket that covers the back panel card connector opening. Save the screw to use when you install the circuit card.

4.    Refer to the documentation accompanying your new card.  If you need to set any switches or move any jumpers on your card, do so now.

5.    Position the edge connector of the new card over the circuit card slot.  Align the card with the front card guide.

6.    Gently, but firmly, press the card downward until it seats firmly into the slot on the main circuit board.

7.    Secure the card support bracket to the chassis.  Use the screw you removed earlier.

## Adding to Your Computer

8.  Replace the cover of your computer. Use the six screws you removed earlier.

9.  Reconnect the video monitor, keyboard, and any peripherals to the computer. Then connect the units to their AC power source.

10. Power up the computer. If a message appears on the video monitor, press the ESC key. If no message appears, press the CTRL-ALT-INS key combination. This takes you to the Monitor prompt where you can update the information in the Hardware Setup/Configuration Program. Refer to Chapter 3 for details.

Adding to Your Computer

# Installing a Numeric Processor

The 80287 numeric processor IC speeds up the handling of numeric data used by some software programs. The processor is installed on the main circuit board at component location U128.

### CAUTION

The 80287 numeric processor is sensitive to static electricity. Handle the processor as follows:

• Before you pick up the IC, equalize the static electricity between the work surface and the IC by touching the work surface with one hand and then picking up the IC with the other hand.

• Once you remove the IC from its protective packaging, do not lay it down or let go of it until it is installed or returned to its protective packaging.

To install the numeric processor:

1. Remove the cover of the computer by following the instructions earlier in this chapter.

2. If necessary, straighten the pins of the IC by laying the IC down on its side and carefully rolling it so that the pins are bent into line. Turn the IC over and repeat the procedure.
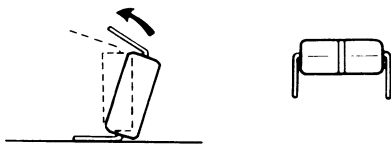
3. Refer to Figure 5-4. Align pin 1 of the IC with pin 1 of U128 on the main circuit board and insert the IC into the socket.
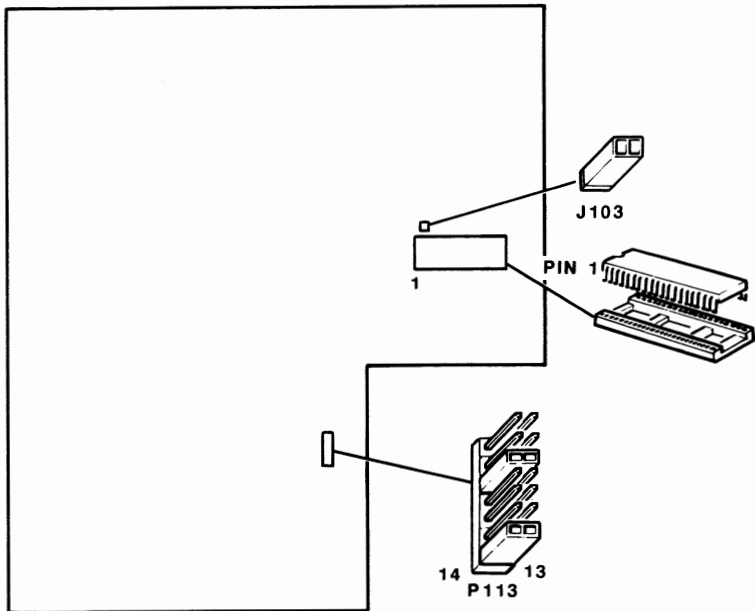
**Figure 5-4.  Installing the 80287 Numeric Processor**

4.    Move the jumper at P113 on the main circuit board from pins 7
       and 8 to pins 13 and 14.

**Table 5-1.   80287 Numeric Processor Jumper Settings**

| PROCESSOR | P113 | J103 |
|---|---|---|
|  | Jumpers on: | Jumper on: |
| 80287 6 MHz (Z-416C, part number 443-1222) | Pins 5, 6, 13, 14 | Pins 1, 2 |
| 80287 8 MHz | Pins 5, 6, 7, 8 | Pins 1, 2 |
| 80C287, 12 MHz | Pins 5, 6, 7, 8 | Pins 1, 2 |
| 80C287, 16 MHz | Pins 5, 6, 13, 14 | No jumper |

5.    Replace the cover of the computer. Use the six screws you
       removed earlier.

## Adding to Your Computer

# Installing Memory Modules

RAM (random access memory) can be expanded to either 3 megabytes or 6 megabytes. When shipped from the manufacturer, your computer has four 256K SIMMs (single, in-line, integrated circuit, memory modules).

• To expand the RAM memory to 3 megabytes, you need to add two 1 megabyte SIMMs at MM105 and MM106 on the main circuit board.

• To expand the RAM memory to 6 megabytes, you need to replace the four 256K SIMMs at MM101, MM102, MM103, and MM104 with four 1-megabyte SIMMs, then add two more 1-megabyte SIMMs at MM105 and MM106.

### CAUTION

SIMM modules are sensitive to static electricity. Leave the SIMM in its protective packaging until you are ready to install it. When you are ready to install the SIMM, handle it as follows:

• Before you pick up the SIMM, equalize the static electricity between the work surface and the SIMM by touching the work surface with one hand and then picking up the SIMM.

• Once you remove the SIMM from its protective packaging, do not lay it down or let go of it until it is installed or returned to its protective packaging.

Adding to Your Computer

To install the SIMMs:

1.    Refer to the instructions earlier in this chapter and remove the cover
      of your computer.

2.    If you are expanding the RAM memory to 3-megabytes, disregard
      this step and proceed to step 3. If you are expanding the RAM
      memory to 6-megabytes, refer to Figure 5-5 and remove the four
      256K SIMMs in order, from MM104, MM103, MM102, and MM101,
      on the main circuit board. Use a small flat-bladed screwdriver to
      push back on the bracket on each side of the module until the
      module clears the brackets. Then tip the module toward the power
      supply and remove the module.
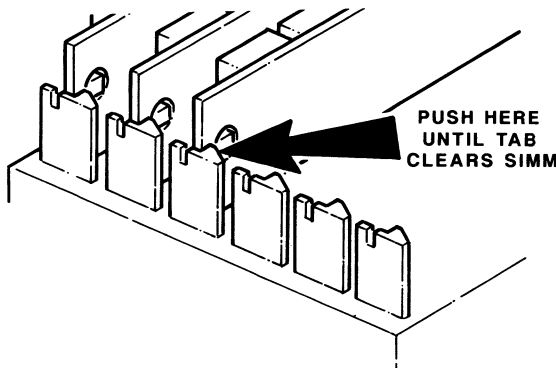


**Figure 5-5.    Removing SIMMs**

## Adding to Your Computer

3.  Install the 1-megabyte SIMMs in the module slots in sequence beginning at MM105 for 3-megabyte expansion or at MM101 for 6-megabyte expansion. To install a SIMM, insert it into the slot at a slight angle. Push it into the slot and then tip it upright. Refer to Figure 5-6.
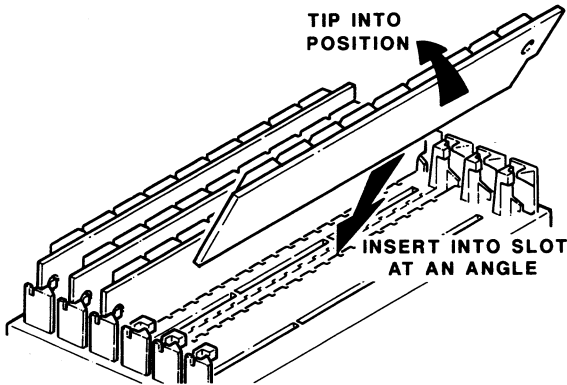


**TIP INTO POSITION**

**INSERT INTO SLOT AT AN ANGLE**

**Figure 5-6.    Installing SIMMs**

4.  If you installed six 1-megabyte SIMMs, move the jumper at J102 on the main circuit board from pins 2 and 3 to pins 1 and 2. If you installed two 1-megabyte SIMMs for 3-megabytes of ROM, leave the jumper at J102 on pins 2 and 3. The jumper locations are shown in the "Main Circuit Board section of Chapter 4.

5.  Replace the computer cover by following the instructions earlier in this chapter.

6.  Run the Hardware Setup/Configuration Program described in Chapter 3 and update the "Main RAM" entry.

Adding to Your Computer

# Installing a 3.5-Inch Floppy Disk Drive

### CAUTION

Before disassembly, place a shipping insert (or an old disk) in the computer's floppy disk drive to protect the read/write heads. Your new floppy disk drive may or may not have a shipping insert installed. If there is none installed, the drive is automatically protected. Your hard disk drive is automatically protected.

**NOTE**: During disassembly, it may be necessary to disconnect various cables. Label the connectors with the mating connector identity as you disconnect them. This simplifies reconnecting them.

To install a second 3.5-inch floppy disk drive:

1.   Refer to the instructions earlier in this chapter and remove the cover of your computer.

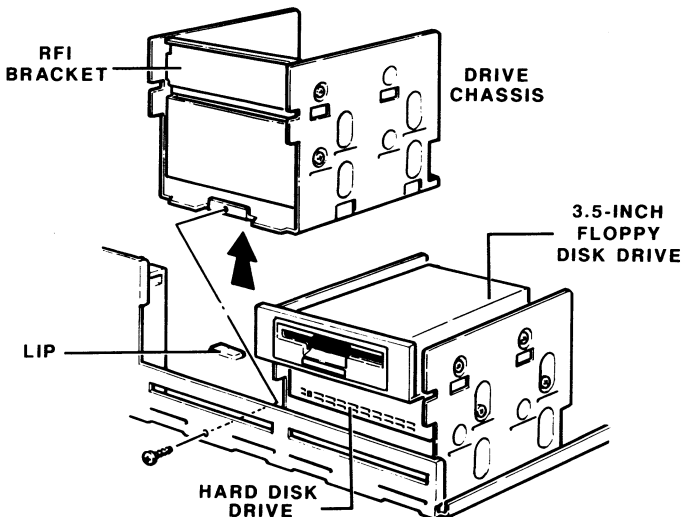2.   Remove the screw from the front of the left drive bracket as shown in Figure 5-7.

**Figure 5-7.   Removing the Drive Chassis**

## Adding to Your Computer

3. Slide the drive chassis towards the rear of the computer until it passes the lip on the bottom of the computer chassis. Then lift the drive chassis straight up out of the computer.

4. Remove the RFI bracket from the drive chassis.

5. Unpack the floppy disk drive. Only part of the items shipped with the drive are used to install it in your particular computer. After you install the drive, you can discard any remaining items. Leave the shipping insert in the drive until installation is complete to prevent damage to the drive.

6. Drives are usually shipped from the manufacturer with the jumper set as drive B (the second floppy disk drive). Verify that the drive select jumper is set to the second position on the new 3.5-inch drive. The location, designation, and type of jumpers may vary, depending on the manufacturer of the drive. Refer to Figure 5-8 for typical locations of drive select jumpers (also referred to as programming jumpers).
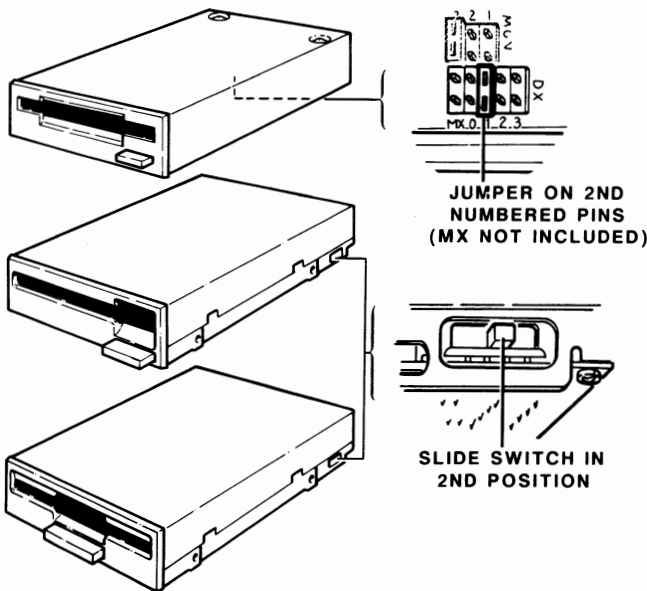


JUMPER ON 2ND
NUMBERED PINS
(MX NOT INCLUDED)

SLIDE SWITCH IN
2ND POSITION

**Figure 5-8. Typical Drive Select Jumper Locations**

## Adding to Your Computer

7. Mount the adapter bracket to the 3.5-inch drive as shown in Figure 5-9. The adapter bracket and hardware to mount the drive are supplied with the drive.
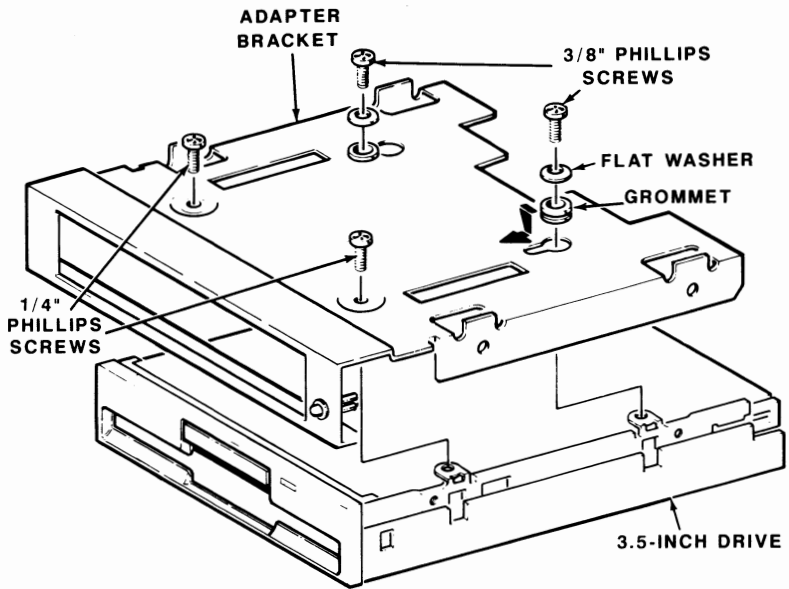


**Figure 5-9.  Mounting the Adapter Bracket to the Drive**

8. After you install the drive adapter bracket, turn the drive right side up. Place the drive into the drive chassis so it rests on the four drive support clips on the sides of the drive chassis.

## Adding to Your Computer

9.  Secure the drive to the chassis using four 6-32 x 3/8" screws, as shown in Figure 5-10.
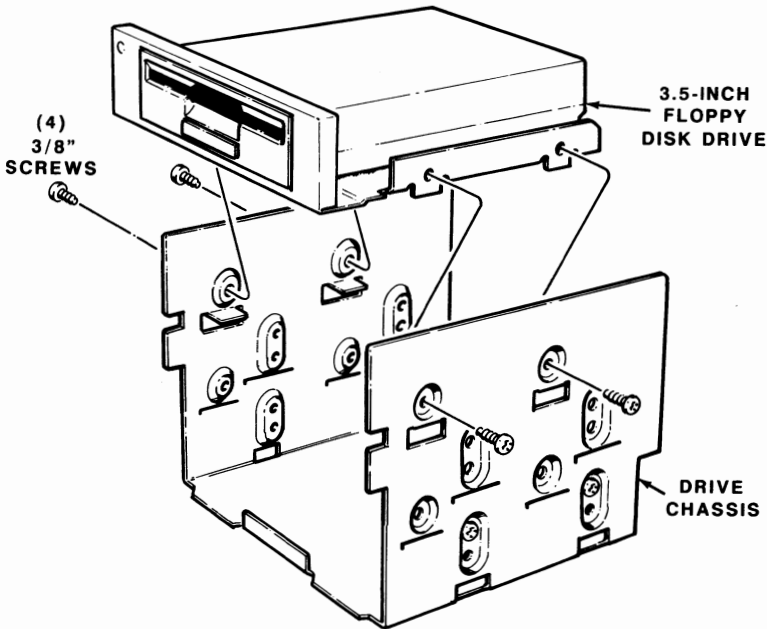


**Figure 5-10.    Installing the Drive Into the Drive Chassis**

10. Reinstall the drive and drive chassis back in the computer. Slide the drive chassis in so that it catches the lip on the computer chassis. Line up the tabs on the bottom of the drive chassis with the corresponding slots on the front of the computer chassis. Refer to Figure 5-11.

11. Secure the assembly at the front of computer chassis with the screw you removed earlier.
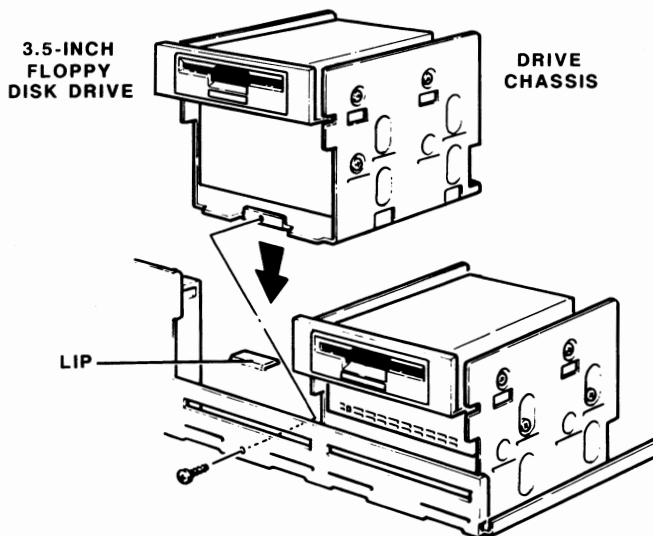
**Figure 5-11.   Reinstalling the Drive Chassis**

## Adding to Your Computer

12. Connect the cable from the floppy disk to the disk controller card exactly as shown in Figure 5-12. Note the position of the stripe on the cable.

13. Refer again to Figure 5-12 and connect a cable from the power supply to the floppy disk drive.
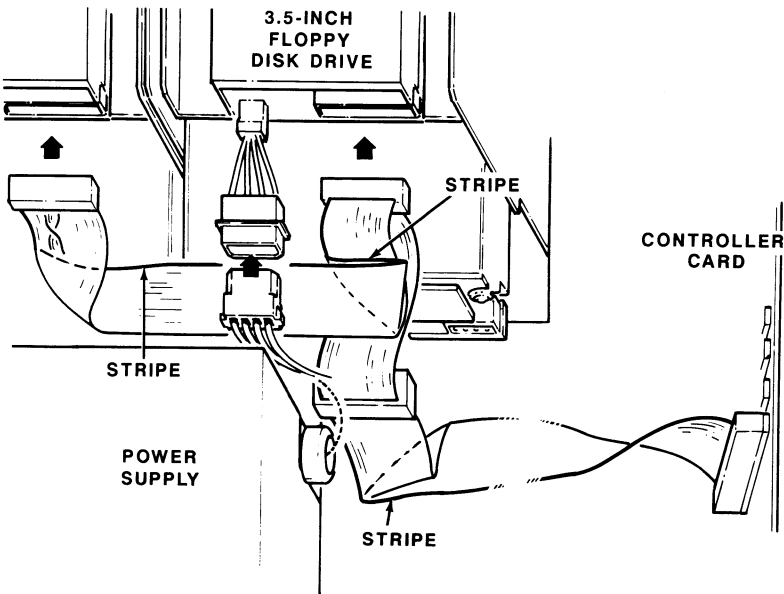


**Figure 5-12.    Connecting the 3.5-Inch Floppy Disk Drive**

## Adding to Your Computer

14. Connect any other cables that you disconnected.

15. Before you replace the cover, refer to Figure 5-13 and remove the screws and L spring brackets that secure the upper right panel insert. Remove the insert. Reinstall the screws and L spring brackets to secure the lower panel insert to the cover.
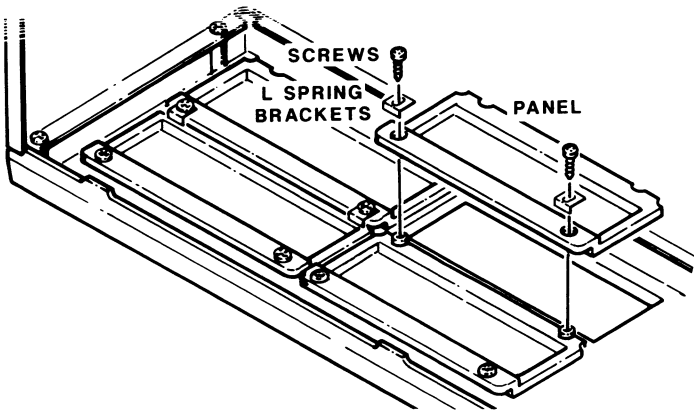


**Figure 5-13. Removing the Front Panel Insert**

16. Replace the computer cover by following the instructions earlier in this chapter.

17. Remove the shipping inserts (if present) from the floppy disk drives.

18. Run the Hardware Setup/Configuration Program described in Chapter 4 and update the "Floppy Drive 1:" entry to include your new drive.

19. Update your operating system so it recognizes the new drive and its location. If you are using MS-DOS, use the DSKSETUP program to do this. (If you are using a different operating system, check its documentation.)

# Adding to Your Computer

# Installing a 5.25-Inch Floppy Disk Drive

### CAUTION

Place a shipping insert in the floppy disk drive to protect its read/write heads during disassembly. Your hard disk read/write heads are automatically protected when you turn off the computer.

During disassembly, it may be necessary to disconnect various cables. If you label the connectors with the mating connector identity as you disconnect them, it will be easier to reconnect them. (Masking tape works well.)

To install a second floppy disk drive:

1.   Remove the cover of the computer by following the instructions earlier in this chapter.

2.   Remove the screw from the front of the drive bracket as shown in Figure 5-14.
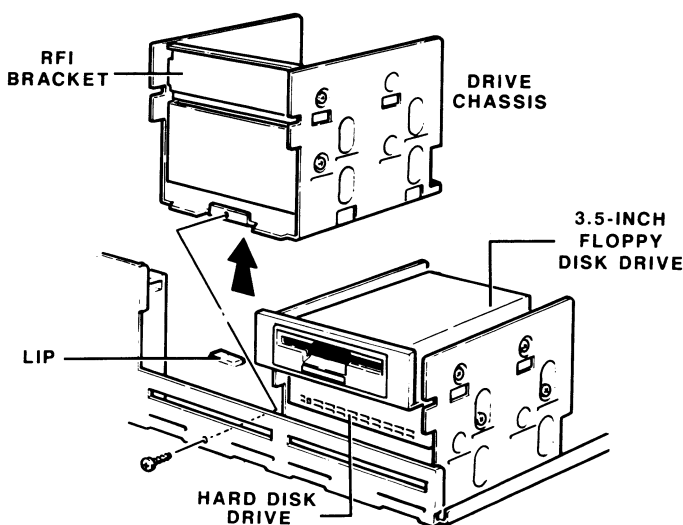


**Figure 5-14.   Removing the Drive Chassis**

3.  Slide the drive bracket to the rear of the computer until is passes the lip on the bottom of the computer chassis. You may find it necessary to disconnect some cables at this point. Next, lift the drive bracket straight up out of the computer.

4.  Remove the RFI bracket.

5.  Unpack the floppy disk drive. Leave the shipping insert in the drive until installation is complete to prevent damage to the drive.

6.  Drives are usually shipped from the manufacturer with the jumper set as drive B (the second floppy disk drive). Refer to Figure 5-15 and verify that the drive select jumper (also referred to as a programming jumper) is set to the second position on the new drive. The location, designation, and type of jumpers may vary, depending on the manufacturer of the drive.
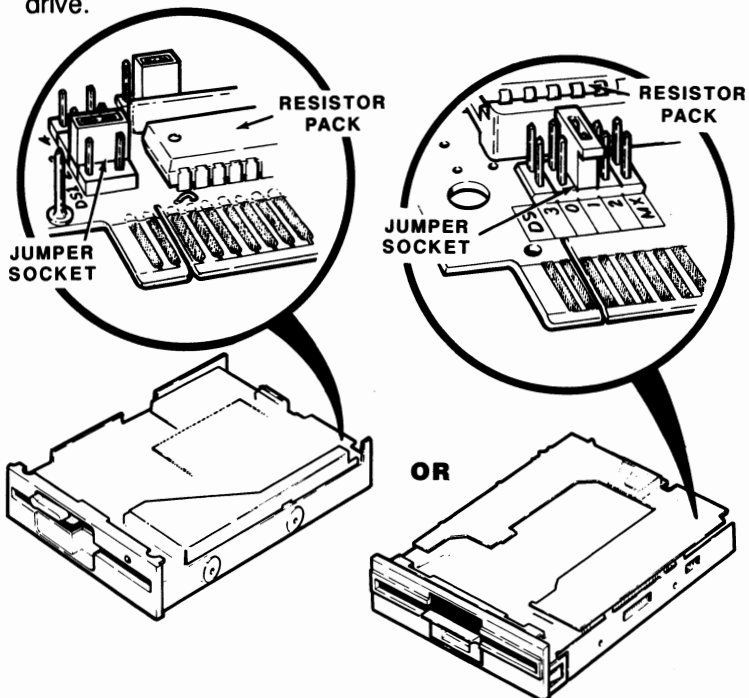


**Figure 5-15.    Drive Select Jumper Location on Typical 5.25-lnch Floppy Drives**

## Adding to Your Computer

7.  Refer to Figure 5-16 and place the disk drive into the left drive bracket. Position the drive so the screw holes on the drive line up with the screw holes on the bracket. Secure the disk drive with the four screws that were packed with the drive.
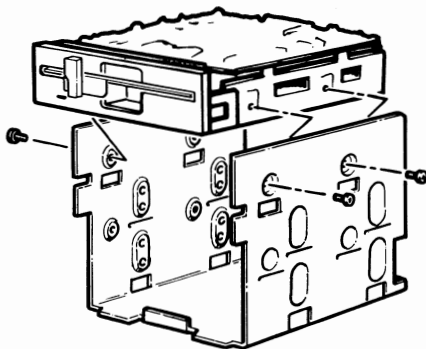
**Figure 5-16.  Installing the 5.25-Inch Floppy Disk Drive**

8.  Reinstall the left drive bracket and drive into the computer by sliding it toward the front of the computer. Make sure it catches the lip on the chassis and that the drives line up with the openings in the chassis. (Refer to Figure 5-17.)
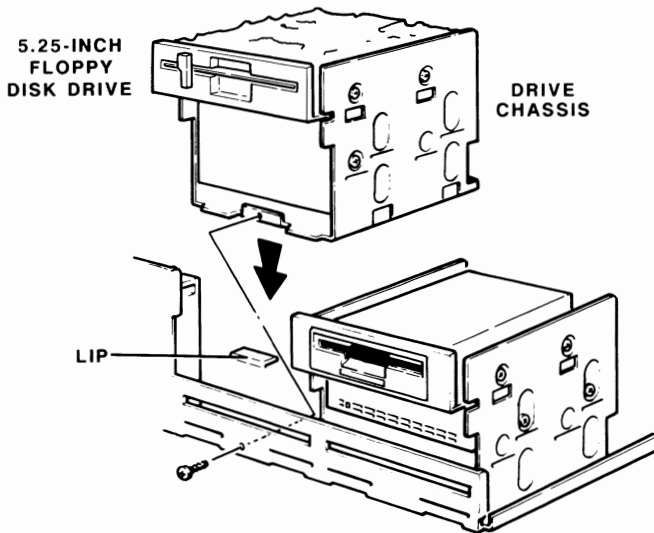


**Figure 5-17.   Reinstalling the Drive Chassis**

9.  Secure the drive chassis by reinstalling the screw you removed earlier.

## Adding to Your Computer

10. Connect the cable from the floppy disk to the disk controller card exactly as shown in Figure 5-18. Note the position of the stripe on the cable.

11. Refer again to Figure 5-18 and connect a cable from the power supply to the floppy disk drive.
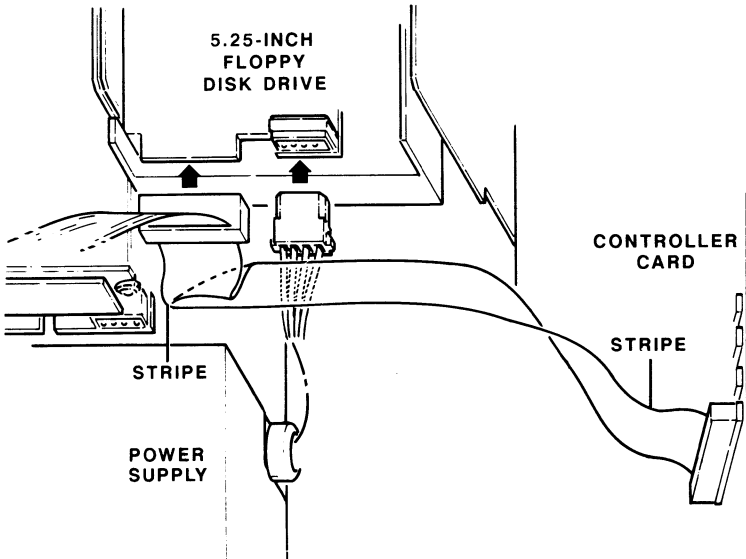


**Figure 5-18.   Connecting the 5.25-Inch Floppy Disk Drive**

## Adding to Your Computer

12.  Connect any other cables that you disconnected.

13.  Before you replace the cover, refer to Figure 5-19 and remove the screws and L spring brackets that secure the upper right panel insert. Remove the panel. Reinstall the screws and L spring brackets to secure the lower panel insert to the cover.
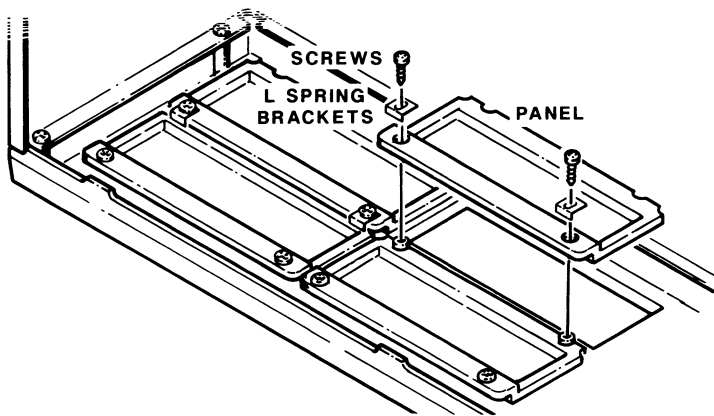


**Figure 5-19.    Removing the Front Panel Insert**

14.  Replace the computer cover by following the instructions earlier in this chapter.

15.  Remove the shipping inserts (if present) from the floppy disk drives.

16.  Run the Hardware Setup/Configuration Program described in Chapter 4 and update the "Floppy Drive 1:" entry to include your new drive.

17.  Update your operating system so it recognizes the new drive and its location. If you are using MS-DOS, use the DSKSETUP program to do this. (If you are using a different operating system, check its documentation.)

## Adding to Your Computer

# Installing a High-Capacity Hard Disk Drive

### CAUTION

Place a shipping insert in the floppy disk drive(s) to protect its read/write heads during disassembly. The heads on the hard disk drive are automatically protected when you turn off the computer.

During disassembly, you may need to disconnect various cables. If you label the connectors with the mating connector's identity as you disconnect them, it will be easier to reconnect them. (Masking tape works well.)

The following procedure tells how to install a half-height hard disk drive in the left drive chassis. If you are installing a full-height hard disk drive, modify the instructions as necessary and install it in the right drive chassis.

To install a second hard disk drive:

1.  Remove the cover of your computer by following the instructions earlier in this chapter.

2.  If you have a floppy disk installed in the upper left drive chassis, disconnect the power supply cable and the disk controller cable.

3.  Remove the screw from the front of the computer that holds the drive chassis in place, as shown in Figure 5-20.
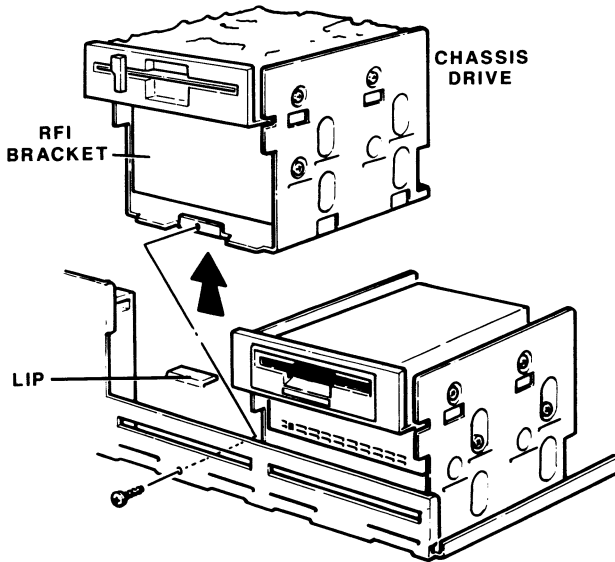
**Figure 5-20. Removing the Drive Chassis**

4.  Slide the drive chassis to the rear of the computer until it passes the lip on the bottom of the computer chassis. You may need to disconnect some other cables at this point. Next, lift the drive bracket straight up out of the computer.

5.  Remove the RFI bracket.

6.  Unpack the hard disk drive.

## Adding to Your Computer

7. Refer to Figure 5-21 and slide the hard disk drive into position under the floppy disk (if present).

8. Position the drive so the screw holes line up with the screw holes on the drive chassis. Secure the disk drive with the four screws that were packed with the drive.
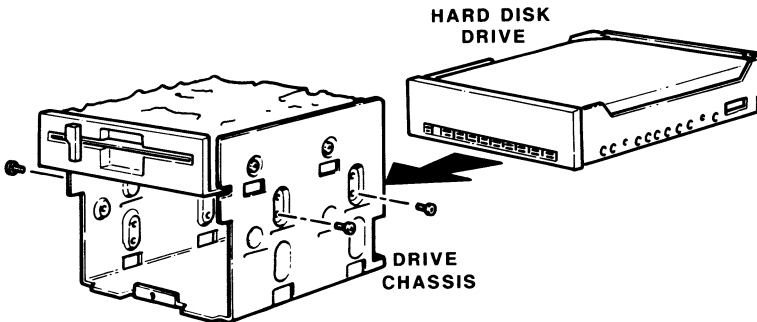
HARD DISK
DRIVE

DRIVE
CHASSIS

**Figure 5-21.   Installing the Hard Disk Drive**

9. Reinstall the left drive chassis and drive(s) into the computer by sliding it toward the front of the computer. Make sure it catches the lip on the chassis and that the drives line up with the openings in the front of the chassis. (Refer to Figure 5-22.)
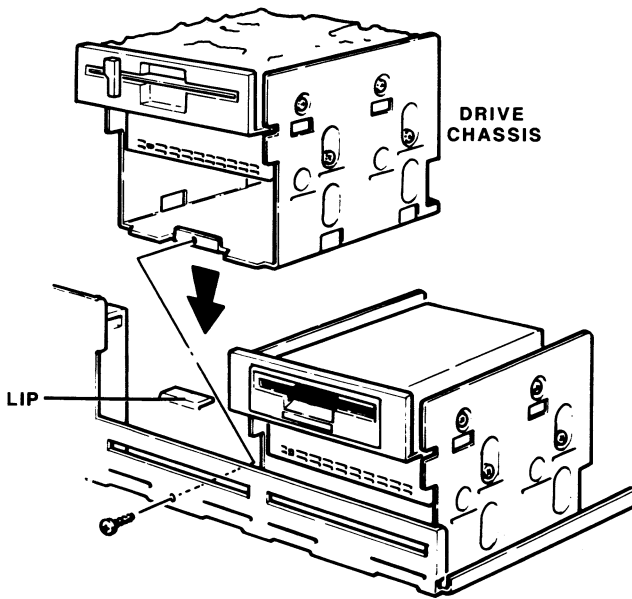


**Figure 5-22.   Reinstalling the Drive Chassis**

## Adding to Your Computer

10. Secure the drive chassis by reinstalling the screw you removed earlier.

11. Connect the cables from the hard disk drive to the disk controller card exactly as shown in Figure 5-23. Note the position of the stripe on the cables.

12. Connect the cable from the floppy disk to the disk controller card exactly as shown in Figure 5-23. Note the position of the stripe on the cable.

13. Refer again to Figure 5-23. Connect the cables from the power supply to the hard disk drive and the floppy disk drive.
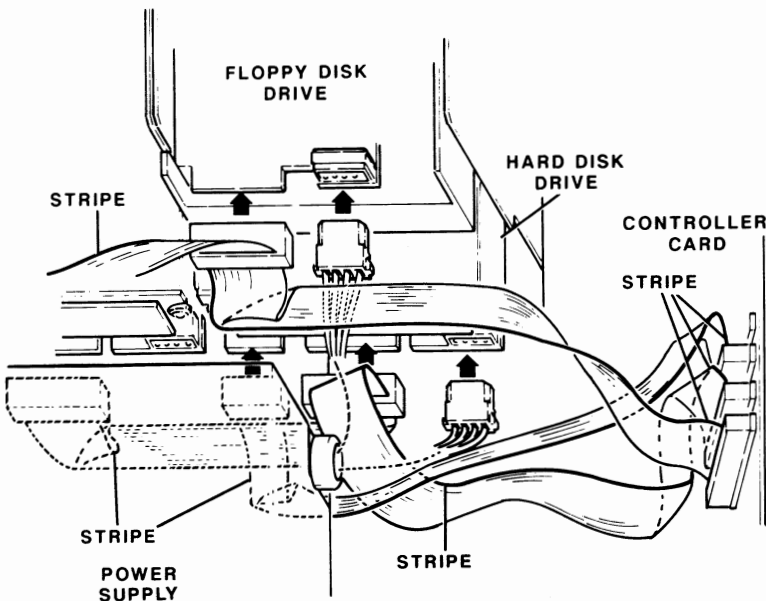
**Figure 5-23. Connecting the Drive and Power Supply Cables**

## Adding to Your Computer

14. Connect any other cables that you disconnected.

15. Replace the computer cover by following the instructions earlier in this chapter.

16. Remove the shipping inserts (if present) from the floppy disk drive(s).

17. Run the Hardware Setup/Configuration Program described in Chapter 5 and update the "Hard Disk Drive 1:" entry to include your new drive.

18. Update your operating system so it recognizes the new drive and its location. If you are using MS-DOS, use the DSKSETUP program to do this. (If you are using a different operating system, check its documentation.)

Chapter 6
# Care and Service

Your computer is well-designed and you can expect years of use with minimum maintenance. This chapter tells you how to clean your computer and change the battery that powers the clock and calendar. It also has suggestions to follow if you have a problem. Often the reason can be easily identified by checking one of the following:

•   The checklist in this chapter, "Check This First." This is a list of conditions and easy solutions.

•   The system-check LEDs on the main circuit board.

•   The "Power-Up Messages" that are listed in this chapter. These messages may be displayed when you turn on your computer. Possible causes for each message are listed.

•   Five keyboard-selectable tests that verify performance of specific areas. These tests are part of the Monitor program.

•   An optional floppy disk with comprehensive diagnostic tests.

Using these resources can narrow down the cause of a problem and greatly reduce service costs and downtime. If service support is needed, information can be found at the end of the chapter.

Care and Service

# Check This First

What first appears to be a serious problem may actually be a minor problem that is easily corrected. Refer to Figure 6-1 and go through the following checklist to find the condition you are experiencing. Then check the possible causes in order.

# Checklist

Nothing happens when you turn on the computer: the power light does not light and the fan does not run.

☐ Make certain the computer power switch is on. If the computer is connected to a switched multiple outlet box or power strip, make sure that switch is on.

☐ Make certain the power cords are connected to a working AC outlet. (Use a lamp to make sure there is power at the outlet.)

☐ Check the power cord for damage. If the cord needs to be replaced, have a qualified service representative replace it with a cord of the same type and rating.

☐ Check that the computer line voltage select switch is set for the voltage in your area.

☐ Remove the cover of the computer and check to see if the system check LEDs on the main circuit board light up and then turn off in sequence.

☐ Check the power supply LED indicators to see if they are lit.

☐ Check the power supply cable connection to the main circuit board. Make sure it is secure.

☐ Check the speaker/LED cable and make sure the connection is secure.

# Care and Service

SYSTEM CHECK LEDS

CPU (CENTRAL PROCESSING UNIT)

ROM (READ ONLY MEMORY)

RAM (RANDOM ACCESS MEMORY)

INT (INTERRUPT CONTROLLER)

DSK (DISK DRIVE)

DCOK (DC OKAY)

-12V

+12V

KEYBOARD
CONNECTOR

POWER
INDICATOR
+5VDC

POWER SUPPLY
CONNECTOR
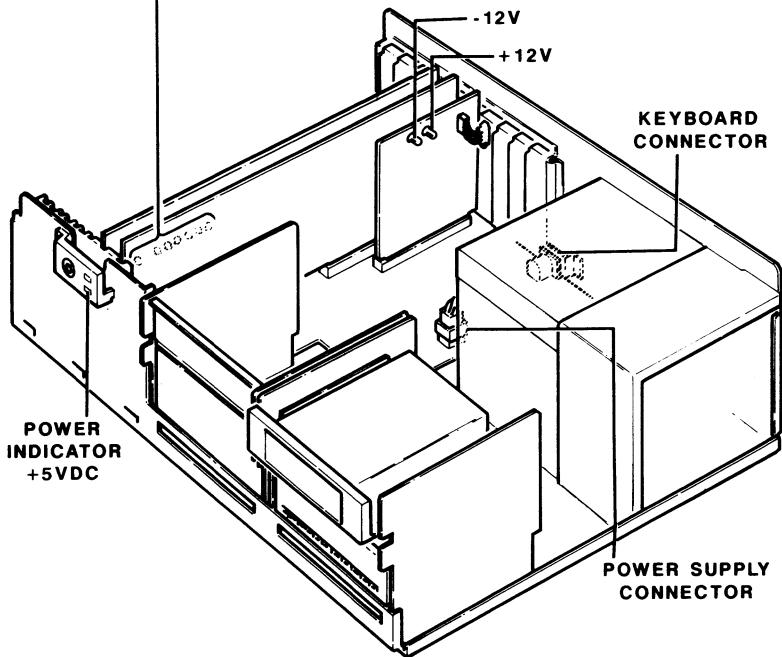
**Figure 6-1.   Checkpoints**

## Care and Service

Upon power up or reset, the computer does not boot automatically.

☐   Check your disk to be certain it is bootable.

☐   Be certain the floppy disk is inserted with the label side up and toward you. It needs to be completely inserted into the drive.

☐   Press the CTRL-ALT-INS key combination to access the Monitor program. Type SETUP and press ENTER. Verify the boot drive entries in the Hardware Setup/Configuration Program. Refer to Chapter 3 for further boot-up procedures.

Computer resets to the power-up point or the disk keeps rebooting.

☐   Check the power cord connection.

☐   Try another bootable floppy disk. The one you are using may not be good.

☐   Check the drive ribbon cable connections.

☐   Verify that all the circuit cards are securely seated in their card slots.

There is no display or a poor display on the video monitor screen.

☐   Check that the monitor is connected to an AC outlet and the power switch is on.

☐   Verify that the connection between the monitor and the computer is secure.

☐   Adjust the brightness and contrast controls on the monitor.

☐   Check that the I/O card and the video card are securely seated in their card slots.

The computer powers up, automatically boots or enters the Monitor program, but nothing happens when the keyboard keys are pressed. The NUM LOCK LED on the keyboard is not on.

☐ Make sure the keyboard is securely connected to the computer.

☐ Verify that the keyboard cable is securely connected to the main circuit board.

## Power-Up Tests and Messages

Your computer's built-in Monitor program automatically performs a series of tests whenever the computer is powered up or reset. If one of the following messages are displayed on the video monitor, check the explanations below to help identify and correct the problem.

```
+++ ERROR:  Please replace the back-up battery! +++
+++ ERROR:  Bad configuration information found in CMOS! +++

--- Errors found!  Please press <Esc> to continue ---
```

These messages mean that the computer has detected a difference between the hardware actually installed in your system and the information about your hardware that is stored in the computer's memory.

If you see any of these error messages, press the ESC (escape) key. The Hardware Setup/Configuration Program will appear on the screen.   Refer to Chapter 3 for instructions and use the Hardware Setup/Configuration Program to update the hardware information stored in memory.

## Care and Service

Generally, once this information has been updated, your computer will operate properly. If, however, this message appears each time you turn your system on, replace the backup battery or contact your authorized service representative.

```
+++ ERROR: CPU failure! +++
+++ ERROR: ROM checksum failure! +++
```

These messages indicate that the microprocessor or read-only memory circuits may not be functioning correctly. Turn the computer off for 20 or 30 seconds while you check the keyboard and other peripheral connectors to be sure they are properly seated. Then turn the computer back on. If this does not correct the problem, contact your service representative.

```
+++ ERROR: Overflow! +++
+++ ERROR: RAM failure! Address: XXXX:YYYY,Bit: X, MODULE: XXX
+++ ERROR: Parity hardware failure! Address: XXXX:YYYY,Bit: X, MODULE: XXX
+++ ERROR: Parity failure! +++
+++ ERROR: Memory Parity Failure! +++
```

If these messages appear, the power-up self-tests of the parity circuitry, system memory, or Monitor ROM were not successfully completed. When module numbers are displayed, it indicates that a memory IC in one of the modules has failed.

```
+++ ERROR:  Timer interrupt failure! +++
```

This message indicates that the interrupt control or timer logic may have failed. If optional circuit cards have been added to your computer, make sure they are properly installed and have been configured correctly.

```
+++ ERROR:   Base memory size error! SETUP: XXXK   ACTUAL: YYYK +++
+++ ERROR:   Extended memory size error! SETUP: XXXXXK   ACTUAL: YYYYYK +++
+++ Divide by zero! +++
```

Usually these messages indicate that the Hardware Setup/ Configuration Program has stored incorrect information in the computer's memory. Press the ESC key and then use the CTRL-ALT-INS key combination to reach the Monitor prompt (->). Run the Hardware Setup/Configuration Program and verify that the Base Memory RAM and Extended Memory RAM designations reflect your hardware. Total memory RAM cannot exceed 640K. Total extended RAM cannot exceed 15232K. If this does not correct the problem, contact your service representative.

```
+++ ERROR:   Keyboard not responding or not connected! +++
+++ ERROR:   Invalid/No keyboard code received! +++
```

The keyboard sends a special code at power-up to tell the computer that it is functioning properly. The most common cause of these messages is a disconnected keyboard. Make sure the keyboard is connected to the computer.

```
+++ DISK ERROR:   Drive not ready! +++
+++ DISK ERROR:   Bad disk controller! +++
```

If incorrect floppy or hard disk drive information has been stored in the computer's memory, one of these messages is likely to appear on your video monitor. Use the CTRL-ALT-INS key combination to access the Monitor program. Run the Hardware Setup/ Configuration Program and verify that it contains the correct drive information.

## Care and Service

Attempting to boot a floppy disk drive with no disk in the drive or a disk that is not completely installed in the drive can also cause these messages. Make sure there is a disk in the floppy disk drive and that the disk is completely installed, then boot the drive again.

Finally, check the ribbon cables that connect the drives to the disk drive controller card. Make sure they are securely seated. (You will need to partially disassemble your computer to check this.) If the message persists, contact your service representative. A faulty disk drive controller circuit or disk drive may be the source of the problem.

```
+++ DISK ERROR:   DMA overrun! +++
```

A faulty disk controller circuit may cause this message. It may also be caused by an optional circuit card. If any optional or nonstandard cards have been installed in your computer, such as a parallel/serial input/output card or game card, remove them and run the power-up tests again. If the problem no longer occurs, replace the cards one at a time and repeat the power-up tests after installing each card. When the computer no longer functions or the error message reappears, the card you last installed is likely to be defective.

```
+++ DISK ERROR:   Disk not bootable! +++
No system
Not a bootable partition
```

Either message may occur when the computer attempts to boot from a disk that does not contain the operating system. Most often, you can correct this by using a disk that has the operating system on it. You may need to format a hard disk and load the operating system onto it. If these messages occur often, have your service representative check the disk drive alignment and disk drive controller circuitry.

## Care and Service

```
+++ DISK ERROR:  Sector not found! +++
+++ DISK ERROR:  CRC error! +++
+++ DISK ERROR:  Invalid address mark detected! +++
+++ DISK ERROR:  Seek failure! +++
+++ DISK ERROR:  Invalid data read! +++
```

Any of these messages may occur when the computer attempts to load the operating system, an applications program, or data from a floppy disk. The most common cause of these messages is a faulty floppy disk. Try using the backup copy of your disk.

If these messages appear often, contact your service representative. Your disk drives may need adjustment or replacement.

```
+++ Non-maskable interrupt! +++
```

This message indicates a possible program execution error. It may also appear if power to your computer has been interrupted. When this occurs, any applications program in progress is suspended, the register contents are saved, and the computer returns to the Monitor program for instructions.

```
+++ ERROR:  Wild Interrupt! +++
+++ ERROR:  Wild Hardware Interrupt! +++
FATAL:  Internal Stack Failure, System Halted
```

These messages occur when something happens that the computer was not expecting. As with a non-maskable interrupt, any applications program in progress is suspended and the computer returns to the Monitor program. With these messages on the screen, the computer is usually locked up. Turn your computer off for at least 30 seconds. Make sure that the keyboard, video monitor, and other peripherals are securely connected. Turn the computer back on and reboot the system. If this does not correct the problem, contact your service representative.

Care and Service

# Keyboard-Selectable Tests

In addition to the Monitor program tests that run automatically each time the computer is turned on, there are five additional Monitor tests that can be selected from the keyboard. Once you choose a test, it runs continuously until you stop it or a error is detected. This is quite useful when a problem is intermittent, time dependent, or the result of a heat build-up.

To select a test from the Monitor program:

1.  Press the CTRL-ALT-INS key combination. The Monitor prompt (->) is displayed.

2.  Type TEST and press the ENTER/RETURN key. The following message is displayed:

    ```
    CHOOSE ONE OF THE FOLLOWING:

    1. DISK READ TEST
    2. KEYBOARD TEST
    3. BASE MEMORY TEST
    4. EXTENDED MEMORY TEST
    5. POWER-UP TEST
    6. EXIT

    ENTER YOUR CHOICE:
    ```

3.  Enter the number of the test that checks the problem area. The following describes your choices.

## Care and Service

**Disk Read Test** — If messages such as DISK ERROR: Drive not ready! or DISK ERROR: Sector not found! are displayed, use this test. With this test, you can determine whether the disk or drive is causing the message.

The test automatically checks the disk drive that you tried to boot from, even if the boot operation was not successful. If you want to test a different drive, use the Monitor program Boot command. (Details are in Chapter 3.)

When you run this test, use a bootable system disk in the floppy disk drive that you are checking. However, if the disk drive is defective, your disk may be damaged. So, be certain you have a backup disk. If you are checking a hard disk drive, be sure the operating system is installed and you have back-up copies.

When you run this test, the LED on the drive glows and the boot tracks on the drive are read continuously. Each successful test is counted and displayed on the video monitor. Allow ten or more successful passes to take place before you press the ESC key to exit the test. If an error is found, Device error is displayed. Contact your service representative for further information.

**Keyboard Test** — If wrong data is displayed after you press certain keys on the keyboard, use the Keyboard Test. Press 2 to choose this test. When the message KEYBOARD TEST appears, press any letter, number, or symbol key. The letter or character then fills the screen and the character code of the key is displayed in the upper right corner.

**Base Memory and Extended Memory Tests** — To verify the operation of the first 640K of read/write memory, press 3 to choose the Base Memory Test. The message SYSTEM AND VIDEO MEMORY TEST is displayed and the computer beeps. The memory bank location being tested is displayed in the upper right corner. In about five minutes, patterns appear on the screen as the video memory is tested.

## Care and Service

Press 4 to choose the Extended Memory Test. This test verifies the operation of memory above 640K. If you do not have more than 640K of memory, NO EXTENDED MEMORY INSTALLED is displayed.

These tests are similar to the power-up tests and use the same messages to alert you to a problem. However, they are more extensive and take between 5 and 10 minutes to run.

**Power-Up Test** — When you first turn on your computer or reset it, a series of self tests are run. When you press 5, these same tests are run continuously. The computer displays the number of successful passes.

When you finish running the tests, press 6 to return to the Monitor prompt (->).

# Replacing the Battery

Your computer has a clock/calendar that runs continuously, even when the computer is switched off. When your computer is off, the clock/calendar runs on battery power. The Setup/Configuration Program also uses this battery to retain data. Occasionally, you may have to replace this 3.6-volt, AA lithium battery on the computer's main board.

When your battery needs replacing, a "replace battery" message is displayed on the video monitor screen. If you see this message, run the Hardware Setup/Configuration Program and make a note of the entries. Then power down the system for a few minutes. Turn it on again. If you still get a "replace battery" message, replace the battery. New batteries are available at your local Heath/Zenith Computer Center.

## Care and Service

### CAUTION

• The lithium battery is not rechargeable; do not attempt to recharge it.
• The battery is safety sealed; do not open it.
• Do not short-out the battery.
• Use care when disposing of the old battery; do not dispose of it in a fire.

To replace the battery:

1. Turn off the power to the computer and all other equipment. Disconnect the AC power cord at the source and then from the equipment.

2. Disconnect the video monitor, keyboard and any other peripherals from the computer.

3. Remove the screws which secure the computer cover. (Detailed instructions are in Chapter 5.) Save the screws for reassembly.

4. Lift the battery from the battery holder on the main circuit board. It is located at the front of the computer next to the drive chassis.

5. Place the new battery in the battery holder as shown in Figure 6-2. Be sure the positive (+) end of the battery is oriented as shown.
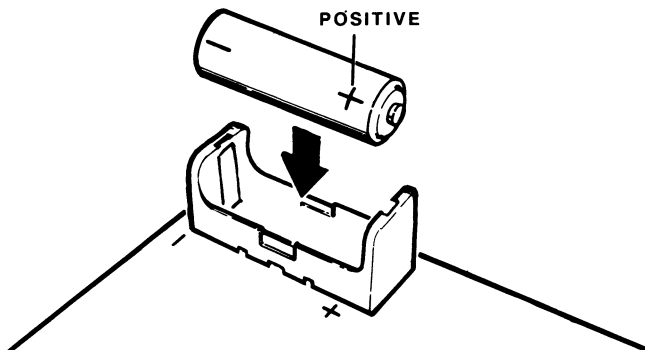


**Figure 6-2.   Installing the Battery**

## Care and Service

6. Reinstall the computer cover with the screws you removed earlier.

7. Reconnect the power cord, keyboard, video monitor, and any other peripherals to your computer. Then connect them to the AC.

8. Power-up your computer. Run the Hardware Setup/ Configuration Program and update the entries. Refer to the notes you took earlier. Chapter 3 has details concerning the Hardware Setup/Configuration Program.

# Caring for Your Computer

Your computer requires minimum maintenance. Occasionally you may want to clean you computer by following these suggestions:

• Wipe dust and fingerprints off the video monitor screen using a soft, lint-free cloth.

• Make sure the computer is off and the power cord is discon-nected. Then slightly dampen a cloth with water and a non-detergent cleaning solution to wipe the cabinet. Never use spray liquids or a soaking- wet cloth.

• Let the computer dry completely before reconnecting the peripherals and turning it back on.

Any part of your system that cannot be cleaned in this manner should be left to qualified service representatives.

# Service Support

All Zenith Data Systems (ZDS) computer products are designed to work together as a complete system. For proper operation, use only ZDS-designed or ZDS-approved equipment.

If further information or service is required, contact your Zenith Data Systems dealer or authorized service center. Have the following information handy:

Computer model number and serial number:_____

   This information is usually on a label on the back of the computer.

Type of video card installed: _____

Model number and
type of video monitor: _____

Model numbers and types
of any other peripheral equipment: _____

Monitor ROM version
and amount of installed memory: _____

   This information appears when you use the CTRL-ALT-INS key combination to access the Monitor program.

BIOS and operating system version: _____

   Load the operating system into computer memory. At the system prompt (such as A>, C>), type VER and press the ENTER/RETURN key. The BIOS and operating system version is displayed.

Any messages displayed by the computer: _____

What the problem is: _____

# Glossary

This short glossary contains commonly-used computer terms that you may encounter while working with your personal computer.

**Address** — The label, name, or number indentifying a memory location, register, or port where data or programming instructions are sent or stored.

**Alphanumeric** — Letters, numbers, punctuation marks, and symbols used to represent information or data.

**Application** — A problem or task that a computer is assigned to perform.

**ASCII** — American Standard Code for Information Interchange. An industry standard used in transmitting information between your computer and other computers, printers, and peripheral devices.

**Autoboot** — The process of automatically loading an operating system into the computer's memory at power up or after resetting the computer. *See also* Boot.

**Backup** — A copy of data or programs that is saved in case the original is damaged or destroyed. Floppy disks are generally used to make backup copies.

**Base memory** — The first 512K or 640K of read/write memory.

**Baud rate** — The rate at which information is transmitted between your computer and a printer, a modem, or other serial device.

**BIOS** — Basic Input/Output System. A program that provides control procedures for all system hardware and peripherals, including the keyboard, video monitor, disk drives, and printer.

## Glossary

**Bit** — A binary digit. The smallest unit of information used by a computer, expressed by a 0 or a 1.

**Board** — A printed circuit assembly that is mounted onto the chassis of a computer or other electronic device. Printed circuit cards may be plugged into a board. *See also* Card.

**Boot** — The process of loading or transferring an operating system from a disk into the computer's memory. Also referred to as booting up. *See also* Autoboot.

**Break** — The process of interrupting or temporarily halting the execution of a program.

**Buffer** — An auxiliary storage area for data. Many peripherals have buffers used to temporarily store data.

**Bug** — A cause of a computer malfunction. The term "bug" refers to hardware faults as well as to errors in software and firmware programs which prevent them from running properly.

**Byte** — A group of eight consecutive bits. Address, instruction, and data words are made up of bytes. *See also* Word.

**Call up** — The process of entering a command or series of commands that cause the CPU to start a particular program and make it ready for your use. For example, the CTRL-ALT-INS key combination "calls up" the Monitor program.

**Card** — A printed circuit assembly that plugs into a printed circuit board. *See also* Board.

**Centronics-type interface** — A parallel interface which has been accepted as a standard printer interface through common usage by a number of manufacturers. The parallel connector on the back of your computer is configured as a Centronics-type printer interface.

## Glossary

**CGA** — Color Graphics Adapter. A type of video display that has been accepted as a standard through common usage by a number of manufacturers. It refers to the resolution of the display, number of colors, and graphics and text modes available.

**Character** — One of a set of symbols (letters, numbers, punctuation marks) used to express information.

**Chip** — An integrated circuit or the package that contains an integrated circuit. A chip is sometimes called an IC. *See also* DIP, IC.

**Class B** — One of two classes established by the Federal Communications Commission (FCC) for regulating the maximum amount of Radio Frequency Interference (RFI) a computer is allowed to radiate. All personal computers for home use must meet Class B requirements.

**Code** — A group of data, instruction, and/or address words specifically arranged to represent a character or to direct the computer to execute a particular application. *See also* Word, Command.

**Command** — A code that directs the computer to perform a particular operation or sequence of operations.

**Configuration** — The specific number and type of major components, such as disk drives, memory banks, circuit cards, and peripheral devices, that make up a computer system. Programming jumpers and switches, operating system configuration, and firmware are all used to notify the microprocessor of your computer's configuration.

**CPU** — Central Processing Unit. The circuitry that processes information, performs arithemtic functions, and controls the rest of the computer system. *See also* Microprocessor.

**CRT** — Cathode-Ray Tube. The television-like screen in a computer terminal or video monitor.

**Cursor** — A character, usually an underline or block, used to indicate a position on the CRT.

## Glossary

**DCE** — Data Communications Equipment. An RS-232C serial connector found on serial peripheral devices, generally modems. *See also* RS-232C.

**Debug** — The process of identifying, locating and correcting any errors or faults in equipment or programs.

**Default** — A standard value or condition under which the computer operates, unless specifically directed to do otherwise.

**Density** — The number of bits per inch (bpi) that can be stored on a disk.

**DIP** — Dual In-line Package. A type of switch with two parallel rows of leads that provide connections from the circuits inside the switch to printed circuit boards or cards.

**Disk** — A mass storage device. *See also* Floppy Disk, Hard Disk.

**Disk drive** — A device used to read and write information on disks.

**Disk operating system (DOS)** — *See* Operating System.

**Display** — The video screen used by the computer to present information to the operator. *See also* CRT.

**DMA** — Direct Memory Access. A technique that transfers information directly into or out of your computer's memory without intervention by the CPU.

**DTE** — Data Terminal Equipment. An RS-232C serial connector, generally found on computers that are sending or receiving serial data. The serial connector on your computer is a DTE connector. *See also* RS-232C.

# Glossary

**EGA** — Enhanced Graphics Adapter. A type of video display that has been accepted as a standard through common usage by a number of manufacturers. It refers to the resolution of the display, number of colors, and graphics and text modes available.

**EMS** — Expanded memory specification.

**Execute** — To perform a command or run a program.

**Extended memory** — Read/write memory installed in addition to the 512K or 640K of base memory; also called protected RAM.

**Field** — A set of related characters, or related information; for example, the Time field on the Monitor program's Hardware Setup/Configuration Program screen.

**Firmware** — Programs, instructions, and data that are permanently stored in the computer's Read-Only Memory (ROM). Firmware may be used, but not altered, by the operator. The Monitor program is an example of firmware. *See also* Hardware, Software.

**Floppy disk** — A plastic disk, coated with magnetic material and enclosed in a plastic jacket, used to store applications programs and data and to transport information from one computer to another. Floppy disks, also called floppy diskettes, flexible disks, or flexible diskettes, come in various sizes and capacities.

**Formatting** — The process of preparing and organizing the surface of a disk to accept programs and data.

**Hard copy** — A paper copy of a computer's output.

**Hard disk** — A term applied to most forms of high-density, fixed-disk information storage. Hard disks may be permanently mounted inside the disk drive or may come in removable cartridges.

## Glossary

**Hardware** — The electronic and mechanical parts of your computer system, including the disk drives, circuit boards and cards, cables, cabinet, power supply, and peripheral devices. *See also* Firmware, Software.

**Home** — This term usually refers to the upper left corner of the video monitor screen, specifically to the first displayable character location.

**IC** — Integrated Circuit. A single piece of silicon or other semiconductor material which contains all the components of an electronic circuit. The term IC is also used to refer to the package that contains the integrated circuit. *See also* Chip, DIP.

**Input** — Information transferred into the computer.

**I/O** — Input/Output. *See* Input and Output.

**Interface** — A term used to describe the connection of one component, assembly, circuit board or circuit card to another. Interface is also used to describe the connection of a peripheral device to a computer. It applies to both the physical connector and the electronic signals at the connector.

**Interrupt** — A technique by which peripherals and the hardware inside your computer notify the CPU that they need information from, or have information for the CPU. When the CPU is interrupted, it temporarily suspends execution of the current program, calls a subroutine from its memory, and services the hardware.

**K** — An abbreviation for kilo. *See also* Kilo.

**Keyboard** — A device used to enter information and commands into a computer. The keys are often arranged like those on a typewriter or calculator.

**Key click** — An audible signal produced by the computer when a key is pressed.

# Glossary

**Kilo** — A prefix meaning 1,000 when used with decimal expressions such as kilometer, or 1,024 ($2^{10}$) when used with binary expressions such as kilobyte. *See also* Kilobit, Kilobyte.

**Kilobit** — A unit of measurement of computer memory that equals 1,024 bits. *See also* Bit.

**Kilobyte** — A unit of measurement of computer memory that equals 1,024 bytes. *See also* Byte.

**LED** — Light-Emitting Diode. An electronic device that glows when current flows through it.

**Load** — The process of entering information into the computer's memory from a disk or peripheral device.

**M** — An abbreviation for mega. *See also* Mega, Megabyte.

**Machine language** — A programming language that uses only numbers. Programmers use it to work directly with the CPU.

**Mega** — A prefix meaning one million ($10^6$) when used with decimal numbers or 1,048,576 ($2^{20}$) when used with binary expressions such as megabyte. *See also* Megabyte.

**Megabyte** — A unit of measurement of computer memory that equals 1,048,576 bytes. *See also* Byte.

**Memory** — Integrated circuits in the computer used to store data and programs. *See also* RAM and ROM.

**Microprocessor** — An integrated circuit package that contains the control and processing portion of a computer. *See also* CPU.

**Modem** — A device that converts digital signals from a computer to signals that are compatible with telephone lines or other communications facilities.

## Glossary

**Monitor** —  1.  A control program resident in your computer's ROM.  2.  A peripheral device used to display information, such as a CRT.

**Monochrome display** — A single color video display, usually black and white, black and green, or black and amber.

**Numeric Processor** — An auxiliary microprocessor dedicated to arithmetic functions, that works in conjunction with the microprocessor to speed up the processing of information.

**Operating system** — A collection of programs stored on disk that provides instructions for the basic operation and management of a disk-based computer system.

**Output** — Information transferred from the computer to a disk drive, video display, other peripheral device, or another computer.

**Parallel** — A method of communicating digital information in which several data bits are transmitted simultaneously, each over its own channel or line.

**Parity** — A method used to check the validity of data that is stored, transmitted, or received.

**Peripheral** — Any equipment that is connected to the computer, including video monitors, printers, and modems.

**Port** — The connector and associated circuitry through which information is transferred into and out of the computer.

**Program** — A set of computer instructions which, when executed, causes the computer to perform an operation. *See also* Firmware, Software.

**Prompt** — A symbol or message indicating that the computer is ready for operator input.

## Glossary

**RAM** — Random-Access Memory. You can change the information stored in this type of computer memory. It is also known as read/write memory. The contents of RAM are lost when you turn off your computer.

**Read/write head** — The part of the disk drive that transfers information to and from a disk.

**Read/write memory** — *See* RAM.

**Reset** — The process of restoring equipment to its initial, power-up state.

**Resolution** — Refers to the sharpness of the display on a video monitor.

**RGB** or **RGBI** — Red-Green-Blue-Intensity. A set of separate video signals used by color video monitors to produce a color display, and by monochrome monitors to produce different shades of one color. The addition of the intensity signal allows many colors or shades to be displayed.

**ROM** — Read-Only Memory. Memory that can be read but not altered. The contents of ROM are not lost when you turn off your computer.

**RS-232C** — A method for wiring serial connectors. The serial connector on the back of your computer is an RS-232C connector.

**Serial** — A method of communicating digital information in which the data bits are transmitted sequentially, one at a time.

**Ship zone** — The space on a hard disk that is reserved for parking the read/write heads so that data will not be destroyed if the heads touch the disks while the computer is being moved, disassembled, or shipped to another location.

**SIMMs** — An acronymn for single in-line memory module.

## Glossary

**Slushware** — When the computer is turned on, the firmware is copied into this space in RAM, where it is ready for immediate use. *See also* Firmware, RAM.

**Software** — Any applications program that can be loaded into a computer.

**TTL** — Transistor-Transistor Logic. A type of integrated circuit that accepts input and produces output at either of two voltages. Since the voltage levels are standard, TTL-compatible devices (like TTL-compatible video monitors) can be connected directly to each other, without the need for special interfacing circuitry.

**Utility** — A program that accomplishes a specific purpose. For example, the MS-DOS SORT utility sorts a data file alphabetically and numerically according to a character in a certain column. Most utilites are included as a part of an operating system.

**Word** — A byte or group of bytes that represent a single address, piece of data, or instruction. Words may be 8, 16, or 32 bits long. *See also* Bit, Byte.

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